THE

ELECTRICAL REVIEW.

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ELECTRICAL REVIEW.

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MUNICIPAL APPOINTMENTS.

FAR oftener than we like do we receive complaints of favouritism in the appointment of public officials. Correspondents who smart under failure to secure berths for which they thought they were fairly in the running, hint at many things that they do not care to enlarge upon for publication. It is favouritism, they say, not merit, that decides who shall succeed. Men elected in the public interests to seats in municipal councils, besmirch our public life, and the reputations of their colleague councillors, by taking private advantage of public office. They are, of course, only the black sheep, but the act of one or two unfortunately discredits the whole municipal family, and men who could, and ought to, serve the public well, too often hold aloof, because the public suspects the candidate for electoral position of having private personal ambitions. Sometimes the misdeeds or unfair favouritisms leak out, and reputations of offenders are nailed to the municipal pump, for all comers to study, and studying to profit thereby. But for every actual case that is revealed there are many others where our correspondents can see nothing more than smoke, the cause thereof lying concealed. We are prepared to make every allowance for a man out of work, or for an unsuccessful seeker after promotion, so in the absence of actual evidence we prefer to take their complaints *cum grano salis*, or, at any rate, very guardedly. Considering that we have such a very large number of councillors, and that there is practically an open door for the lowest and least educated class of man with little more than his bag of tools to call his own, to obtain office, also that too many men of the right stamp regard municipal life with contempt, our standard of municipal purity as revealed is wonderfully high, but that standard will only be maintained, or improved upon, by our making as public as possible an example of those whose guilt is proved. The Guardians prosecutions of several years ago cleared the air very considerably, and in doing so must have caused much fluttering in the dovecotes of the undetected ones. These prosecutions related more to dishonesty in contract transactions. It would not be wise to write all the things we know about some municipal appointments, how they have been arranged or secured, how councillors have even tried to arrange matters with prospective candidates in advance before anyone was supposed to know who the candidates were! We do not ask engineers who have had experiences of these kinds to write them to us, for some of them are better forgotten—we do not want to stir up mud, especially when we remember that councillors are ever on the change, and that those now in office might be reflected upon by allusion being made to the sins of their predecessors in office. But while we do not ask for such epistles, we do not doubt that these few words will remind this and that electrical engineer of something he has either experienced himself, or has heard of concerning some *confrère*. When men whose occupation

brings them in a pound or two a week have the giving away of berths varying from three to ten times their own annual incomes, they are plunged into a new and unaccustomed sphere that is attractive, no doubt, but one which is fraught with dangers unless the councillor's moral standard be absolutely beyond reproach. But as we have said, we do not believe that cases of public office being made to save personal ends are numerous. One actual case may set suspicions working in a dozen places, and legendary growths are matters of common occurrence. It is quite easy to allow mistrust to be engendered for which, if one knew the actual facts, there would be no justification. We ought to be carefully on our guard before we sear the reputation of any man. We may be very confident that we are the only person on earth possessing the advertised qualifications for a particular post—that is a mistake to begin with, for there are a good many things about that job that we know nothing of, and there are more good men about than we remember until we enter into competition with them. Tell us that somebody who is a far-removed relative of the least influential member of the Committee has secured the appointment, and we are quite ready to believe that his success was unfairly come by. Sometimes our suspicions may be justified.

Only last week, according to the *Daily Express*, one of the London Borough Councils was engaged discussing an unwise action on the part of one of its Aldermen and its electrical engineer. The agenda, it seems, contained the following :—

That the committee find that a young man, who is the son of Alderman Hennessey, was engaged at the King's Road Station in April, 1909, as an improver, under the name of MacCarthy, at the suggestion of the chief electrical engineer and with the consent of Alderman Hennessey.

After discussion at the St. Pancras Council meeting, it was resolved to let the matter drop, "as it was considered" (we are quoting from our daily contemporary) "that Alderman Hennessey had been punished sufficiently by the appearance of the Committee's finding on the Council's agenda. Arrangements have been made which will prevent anything of the kind occurring again. Mr. Hennessey is a Socialist Alderman, and a J.P."

But what about the remark "at the suggestion of the chief electrical engineer"? We are sorry that that appears in the minutes, and that it has gone forth to the public. There might have been nothing whatever wrong in the appointment of Hennessey under his own name, he may be most acceptable as an improver in a central station, but suspicions of unfairness and favouritism are likely to arise when there is an attempt to make Hennessey appear to be somebody else because he is the son of an Alderman.

Common-Sense Contracting.

A NOTE appeared in our "Contracts Closed" column last week on the results of tenders for motor-generators for the London County Council. The order was placed with Messrs. Dick, Kerr & Co. at a price considerably above the lowest tendered because the Council "already had a number of their machines of the kind working satisfactorily." Without in any way casting aspersions on those firms who quoted lower prices, it may be said that this is a somewhat unusual step to take, and the County Council may be congratulated on allowing a question other than that of first cost to influence its decision, though this is a policy that has by no means usually been followed by municipal bodies in recent years.

It is a frequent complaint of the municipal contractor that manufacturing goodwill must be regarded as a very small asset, and that any special pains to make a good job, give extra assistance, or do work beyond the strict letter of the contract, are to all intents and purposes thrown away if in future competition for work a rival contractor, perhaps one without the same reputation or experience, happens to quote a few pounds lower.

It has often happened that after one make of plant has given satisfaction, a cheaper make has been adopted on extensions being required, and not merely has the cost of upkeep or loss from breakdowns been many times the saving in first cost, but the reputation of the undertaking has suffered in consequence. One of the chief arguments against municipal trading is that highly technical business departments are too much under the control of committees of laymen, who frequently disregard the recommendations of their salaried engineers.

It may be said that those who have given practical credit to contractors for good work done, while at the same time encouraging reasonable competition, obtain far more satisfactory results, in the long run, than those who jump at the lowest tender regardless of obvious circumstances, and in consequence turn their power stations or other undertakings into collections of odd and assorted plant.

One can, however, go to the opposite extreme in this question of preference, and some of the leading manufacturers of electrical plant have at times made loud complaints of consulting engineers, favouring certain concerns, particularly those from abroad, and refusing to allow British firms of repute reasonable opportunity for tendering for important work. This has especially been the case in some classes of work in connection with mines lighting and power stations.

Experts are employed by municipal bodies and private parties for the purpose of preparing designs, issuing specifications and adjudicating on the most favourable all-round offers received. The effect of placing all orders in one direction, on the ground that some machinery manufactured in this country during the early days of high-tension work gave trouble, or that responsible firms at home have not previously supplied plant fitted with easily designed details, is not only to purchase at non-competitive prices, but also to defeat the main object with which experts are employed, that is, to furnish technical advice and unbiased opinions.

Some engineers think themselves hardly used when their motives are questioned by those in the trade, after one firm has been particularly favoured to the practical exclusion of all others, but in matters of this kind, the more open and above-board the inquiries and contract arrangements, the less is the opportunity for dissatisfaction on the part of unsuccessful tenderers.

The remarkably good results so far obtained from the engines, turbines, generators and sub-station plant of British design and construction, supplied to the London County Council, at a time when very little had been attempted at home previously on so large a scale, tend to show that those who run down all plant made in this country, or confine all their orders to one firm, must be actuated not merely by prejudice, but must be in a state of ignorance of the all-round progress that has taken place at home in recent years.

The Effect of the Eight Hours Act.

THE need for engineers in charge of large central stations to keep a sharp eye upon the quality of the fuel which is now being delivered to them, especially when this fuel is slack or small coal, is emphasised strongly by some figures which have been published lately in the chief organ of the coal mining industry in this country,* relating to the increase in the percentage of ash in the small coal produced by the South Wales coal mining district.

In the year 1887 the percentage of ash in the coal from 16 leading collieries using Cardiff as their port of shipment averaged 8·43 per cent., while in August, 1909, the corresponding figure was 14·2 per cent. Similarly, in Monmouthshire the percentage of ash has risen from 12·04 to 15·58 per cent. To quote the paper and article from which these averages are compiled :—

This statement speaks very largely for itself, and will probably both astonish and grieve those who have at heart the best interests of the trade. It will be seen that in many cases the yield of ash has been doubled; that in a few it has been more than trebled; and that only in rare instances has it been kept stationary. Of course, analyses vary appreciably, even in short periods, but they have never shown such unsatisfactory results as they have done since the Mines Eight Hours Act has been in operation. In order

Iron and Coal Trades Review, September 24th, 1909, "The Small Coal Problem."

to minimise that Act's restrictive effect on outputs, every effort has been made by colliery managers to accelerate the rate of production, and, apparently, one of the many consequences, unfortunately, of these efforts, has been increased carelessness in the filling of trams, and a corresponding decline in the quality of small coal. A few instances may be mentioned in illustration. In February last, the percentage of ash yielded by colliery A was 11·20—last month the percentage was 14·18; in the case of D it has increased from 10·83 to 13·28; whilst in other cases it has increased from 8·90 to 13·96—from 11·0 to 13·52—from 11·32 to 12·40—from 11·10 to 13·96, and from 16·36 to 18·88.

As proof that this deterioration in quality is not confined to the South Wales mining district, we may quote the experience of a firm in South Lancashire, who have been sampling and testing their supplies of small coal regularly since the beginning of the year, and who have found a notable increase in the percentage of ash in the coal delivered during the last two months.

Under these circumstances we advise all engineers to peruse carefully our leading article of September 24th, upon "Fuel Supply Contracts," and to consider whether it will not be advisable to adopt one or other of the systems of purchase there referred to, in the framing of the fuel contracts for the coming year.

The Japan-British Exhibition.

We have received from Mr. W. H. Stentiford, the secretary of this Exhibition, which is to be held at Shepherd's Bush next year, a batch of documents describing the undertaking. Electrical firms who propose taking an interest in the matter can obtain copies of the prospectus by writing to him at the Exhibition Offices at the Exhibition. It is expected that the unique character of the Far Eastern exhibit, which is wholly under the auspices of the Imperial Japanese Government, will have greater drawing powers than even the Franco-British Exhibition. Though the Exhibition is not officially recognised by the British Government, a keen interest is being taken in it by many of the most eminent personages in the kingdom and by members of the Government, and it is hoped that the British section will not be less interesting than the display of arts, crafts and products of Japan and its neighbouring countries. The members of the British electrical industry are being circularised, drawing attention to the excellent opportunity that will be afforded of bringing our manufactures under the notice of the many Far Eastern and other desirable foreign visitors—possible purchasers of engineering material. Many visitors are expected from the Continent and America. We have before us a plan showing the proposed arrangement of the different classes of engineering exhibits in the Machinery Hall. The electrical engineering exhibits will lie between the spaces devoted respectively to gas and mechanical engineering stands on the British side of the Hall. A supply of direct, single-phase and three-phase current will be available for lighting and power. The tariff for space will be the same as at the Franco-British Exhibition of last year. Mr. Stentiford will send copies of the plan, together with space application forms, to any firm interested in the matter. We hope that our manufacturers will not allow the matter of this exhibition to be shelved without giving the fullest possible consideration to the chances of deriving benefit directly and otherwise from a demonstration of their capabilities before Far Eastern visitors.

The Rolled Steel Wheel.

Not so long ago there was considerable controversy as to the best type of wheel for electric tramcars, but the struggle then was between chilled iron and steel tires. It was well fought upon both sides, and the steel tire won in the end, although the chilled wheel is used largely still in its home across the Pond, and in the British home of its adoption.

During that controversy whispers reached us of another rival in the field, and in the interval we find it a champion grown, already at fisticuffs with its fore-runners. This is the rolled-steel wheel, partaking of the nature of both predecessors, for it is solid like the chilled iron wheel, and it is made of the same material as the rolled steel tires. Therefore, if the newcomer finds the universal favour which some of its admirers predict, it may be said that the battle between "chilled" and "tire" resulted in no win for either but a compromise.

It is evident, from the report presented by a committee to the American Street and Interurban Railway Engineering Association, that the rolled one-piece wheel is making rapid progress in the U.S.A. Fifty companies returned data on these wheels, and it is said that many of the larger concerns are adopting them as safer and more economical than the steel-tired wheel.

The diameters used vary from 30 in. to 37½ in., and the radial wear seems to be the same, whether tired or solid wheels are used. In some cases rims are worn to an extreme limit of ½ in., but the majority of roads use limits ranging from 1 in. to 1½ in.; ¾ in. is considered perfectly safe with a rolled steel wheel, but tires worn to this degree tend to loosen.

As might be expected, the wheel makers were not anxious to give away anything about the composition of their products, and only one reply was received to the question asking for specifications. This maker uses the following mixture :—

Carbon	...	0·65 to 0·85 per cent.
Manganese	...	0·60 to 0·90 per cent.
Phosphorus	...	0·60 per cent.
Silicon	...	0·15 to 0·35 per cent.
Sulphur	...	0·05 per cent.

As no indication is given of the status of this maker, or where his wheels are marketed, it is not possible to judge whether the analysis is good, bad or indifferent in practice, although it appears to be similar to the usual composition of British steel tires.

Probably it is the same maker who provides an interesting outline of the process of working up the wheel from the ingot. A long ingot is cast vertically and cropped cold, discarding all segregation and shrinkage defects. The resulting billet is pressed into rough shape under a 12,000-ton hydraulic press, whence it emerges from 6 in. to 10 in. less in diameter than the finished wheel. It is of the utmost importance that the metal shall be homogeneous and solid, and the centre of the "blank" which comes from the press contains any piping or segregation. The centre is punched out to make the bore of the wheel, so that the imperfections are removed in the punching, which weighs 18 lb. and upwards. The blank is now rolled in a specially-constructed very heavy mill, in which the work is done on the plate (web) and rim, expanding the diameter until the finished section is obtained. The rim is entirely surrounded by rolls, except that portion from which the web springs. Rolling increases the density of the metal, as with steel tires and rails.

Makers are unanimous in declaring that the rims of rolled-steel wheels are uniformly hard throughout their depth, but the experience of users is that the last turning is slightly softer than the first.

The Committee conclude that at the present time there is not enough experience to enable them to make a definite statement as to which type of wheel is preferable; but it would seem reasonable, in their opinion, that a one-piece wheel should be better, or at least safer, than one made of several parts. Although the rims are not quite homogeneous throughout their life, they have a greater safe-wearing depth than steel tires, and the scrap value is in favour of the one-piece wheel.

Little or nothing has been heard of the rolled-steel wheel on this side of the water, but American practice is sure to be reflected here sooner or later, just as British improvements always influence American standards, albeit without much acknowledgment in most cases. Oft-times an innovation is overtaken by the fate which is natural to exotics treated as hardy plants, but upon occasion a long and useful life follows the transplantation. In this particular case the chances seem to be that the rolled-steel wheel will strike a true graft in these islands, but it may not be for another while.

FEATURES OF THE DESIGN AND OPERATION OF ROLLING MILL MOTORS AND THEIR ACCESSORIES.

By W. MANKTELOW.

A reasonable knowledge of the general method of manufacturing iron and steel rolled sections is here assumed in order to allot the maximum space possible to the consideration of the following matters :—(*a*) A brief discussion of the relative advantages of electric and steam drive for the rolls ; (*b*) the energy and horse-power required in rolling mill motors ; (*c*) the proportion of the maximum H.P. demand that need be taken as the basis of the continuous rating of the various machines ; (*d*) allowance to be made for auxiliaries ; (*e*) types of electric motor used for roll driving ; (*f*) gearing of motors to rolls and reversal considerations ; (*g*) use and design of fly-wheels as large energy reservoirs ; (*h*) secondary batteries as load equalisers.

(*a*) *Electrical v. Steam Driving.*—Electric driving for rolling mills has now proved commercially economical in working over periods of several years in many Continental and American works, and is at present installed in several large English concerns. The high capital cost of electrical operation, particularly when its adoption necessitates the scrapping of an existing steam plant, is its chief objection ; but even so, it has been repeatedly justified by results. By the substitution of an electric for a steam drive, it is usually possible to work at higher daily outputs while running shorter shifts and employing fewer men.

Not only is electric operation more efficient, it is also more reliable and steady ; this, combined with the higher rolling speeds permissible, results in an increase of output of from 20 to 50 per cent. being obtained. Electric motors and their control gear occupy far less floor space than the corresponding steam equipment, and extensions are more readily made. The adoption of electric drive for the mill motors is usually accompanied by a complete replacement of all steam power in the works, all the advantages consequent on the centralisation of power then accruing. The ease with which the energy consumption in any operation can be accurately measured is a most valuable feature in aiding the evolution of economical means of working.

(*b*) *Energy and Horse-Power Required.*—The *energy* required to effect a given purpose is naturally the true criterion of the efficiency attained, the *horse power* expended being mainly concerned with the speed of working. In the present case, however, the capital cost of the installation and hence its indirect working charges depend on the horse-power that must be installed, hence the importance of the latter amount. The energy required per ton of metal rolled depends on the weight and shape of the block dealt with and of the section ultimately required. In general, the heavier the ingot, the less rolling it needs, and the more compact its initial and final forms, and hence the hotter it keeps during rolling. The energy consumption per ton rolled is, therefore, less in such cases than in the case of light rails, channels, plates, &c., where the relatively large surface and great length of material per ton weight favour rapid cooling and high roll friction. Plates, for instance, frequently cool from 1,200°-1,300° C. to 800° C. during rolling, so necessitating a large increase in the relative energy expenditure during the final passes. As illustrative of this point and as a useful guide for estimating purposes, the following figures may be noted :—

	KW.-hours per ton.
Mean energy consumption for rolling rods and rails ...	42·3
" " " " channels and plates	91·1
Mean of 20 tests, including both the above sets... ...	59·4

As regards the horse-power allowance to be made when designing a new scheme, figs. 1 and 2 present useful information. Fig. 1 shows the relationship between the prolongation of ingot and the horse-power per ton of ingot for various weights of the latter. For a fairly low number of prolongations, say 10 to 20, it is necessary to install motors relatively far more powerful than are required for heavy blocks whereas, as the number of prolongations increases, the horse-power allowance approaches a common value for all cases (roughly 4,000 H.P. per ton of ingot).

Fig. 2 shows the increasing horse-power necessary if higher outputs per hour are to be attained ; the number of passes per ingot must be reduced by the use of a heavier draught, this being made possible by the more powerful motors installed. Under these conditions the horse-power required per ton of

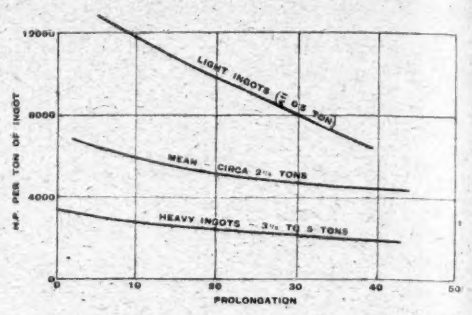

Fig. 1.—Curves Showing Relation Between Ingot Prolongation and H.P. per Ton.

output per hour falls rapidly as the latter increases. The advantage of working on as large a scale as possible and of keeping the whole plant fully loaded is emphasised ; by this means also the relative importance of friction losses is reduced to a minimum. To obtain the maximum output from the installation, it is advisable to arrange the passes and draught in each case so that the motor torque is constant so long as the machine runs at about the same speed. Such improvements in manipulation as the introduction of hydraulic or electrically-operated tipping tables, live rolls, furnace chargers and withdrawers, &c., as well as the higher speeds consequent on electric driving, have resulted in great reductions in working costs.

(*c*) *Power for Auxiliaries.*—Among the chief auxiliaries of a rolling mill are the live roll motors, tipping tables, and so on, while the excitation of the main motor and the

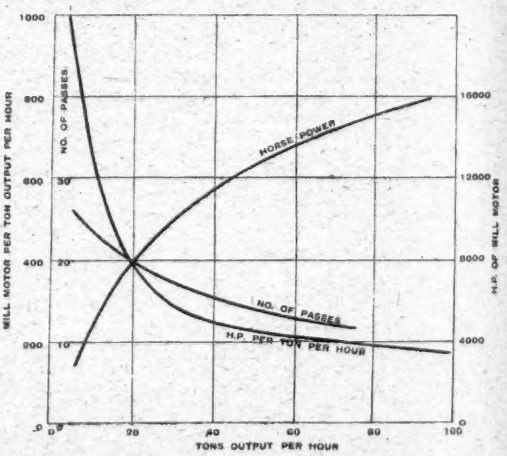
MILL MOTOR PER TON OUTPUT PER HOUR
NO. OF PASSES
H.P. OF MILL MOTOR
HORSE POWER
NO. OF PASSES
H.P. PER TON PER HOUR
TONS OUTPUT PER HOUR

Fig. 2.—Curves Showing Relation of H.P. and Output.

machines of the fly-wheel set and their auxiliaries require a considerable expenditure of energy. The "live" or traversing rolls require 50-100 H.P. each in many cases. In a particular installation each of the live rolls (before and behind the main rolls) was fitted with two 40-H.P. series motors, running at 500 R.P.M. and of 200 kg. m. torque ; while in another equipment 80 H.P. was required to excite the generator and mill motor fields and the special accumulative compound winding for the latter. In most cases the auxiliary energy consumption amounts to from 5 to 10 per cent. of the total.

(*d*) *Types of Motor Used.*—The load on rolling mills being one of the most variable kinds to which electric motors are applied, it is obvious that shunt motors are not suitable for the purpose, though in at least one installation two 3,500-H.P. D.C. shunt motors are used for such a load. The armatures are on one shaft, and the extreme overload capacity of the two machines is 30 per cent. above the normal maximum of 7,000 H.P. Simple series machines are impossible because of their racing tendency on light

load and their too drooping speed characteristic on heavy load. Thury series motors have been successfully employed, and possess many valuable features in this connection. It is obvious that, being constant-current machines, no harm can be done to them, even should they be brought to a standstill by an overload. A fly-wheel is still employed as an equaliser in such cases, but is placed on the same shaft as the generator and prime mover. The generator voltage is automatically varied as required by the load. The motors, being direct-current machines, are more suitable for their work in many respects than alternating-current machines. No switchgear, beyond a simple "on" and "off" lever, is required, all regulation being automatically effected by brush movements on the generator. Such a simple and robust system, though open to the grave dangers of all constant-current systems, is otherwise excellently suited to its work, its surroundings and its manipulators.

Accumulatively compounded D.C. motors have a very suitable speed characteristic for the present purpose, though it is no longer necessary to rely wholly on a drooping characteristic in the main motor to enable the fly-wheel's stored energy to become operative. The fly-wheel or buffer battery, as the case may be, is electrically compelled to take on part of the load when necessary.

Three-phase motors are very common, not because of any inherent advantages in their characteristics, but because of the well-known conveniences afforded by alternating currents where large amounts of energy are concerned. In practically every instance a modified Siemens-Ilgner winding equipment is employed.

In April, 1908, 230 rolling mill motors in Europe totalled 190,000 normal H.P. and 410,000 maximum H.P. (according to Hooghwinkel), giving an average of 830 H.P. each and a mean overload capacity of 2·15 : 1. The largest single motors regarding which information was then available were the two 7,500-H.P. machines of the Rombacher Hutte—both coupled to the same shaft.

Overload capacities of 3 : 1 for short periods are not uncommon in rolling mill motors, which have, in general, to operate under a worse load factor than colliery winding engines in spite of recent improvements (the figures in the two cases being 40 per cent. and 49 per cent. respectively). Where an electro-mechanical fly-wheel storage system is employed, as is usual in electrically-driven mills, the horse-power of the converter motor, *i.e.*, the *steady* horse-power supplied to the circuit usually varies from $\frac{1}{5}$th to $\frac{1}{10}$th the maximum output of the main motor. In several of the largest Continental and American installations the ratios have the values shown in Table I (see also fig. 3 for mean values).

TABLE I.

Maximum H.P. of main motor.	H.P. of converter motor.	Ratio.	Main motor. H.P.	Converter H.P.	Ratio.
± 15,000	2,800	5·35 : 1	± 12,000	1,000	12 : 1
± 10,000	1,400	7·15 : 1	± 12,000	1,800	6·7 : 1
± 7,000	1,300	5·4 : 1	± 10,000	1,000	10 : 1
± 3,600	950	3·8 : 1	± 4,000	700	5·7 : 1
± 9,000	1,200	7·5 : 1	± 1,100	100	11 : 1

(*e*) *Gearing and Time of Reversal, &c.*—As a rule the driving motor is direct coupled to the roll shaft, some degree of flexibility in the coupling being desirable in the case of motors of very large horse-power. Convenient forms of flexible couplings for such machines consist of 20 or more tapered steel rods or leather bushings in the holes for the bolts of the flange couplings.

If the main motor be not direct-coupled to the rolls it is geared down to them, usually in the ratio 2 : 1 or 5 : 1, the torque available at the rolls being correspondingly increased. In some cases the roughing rolls are direct-coupled to the driving motor, the finishing rolls being rope-driven from pulleys on the first shaft; such an arrangement is neither neat nor convenient, but is cheap. The arrangement, employed in some installations, of assisting an electric motor direct-coupled to the rolls by a gas engine, also coupled-up when needed, is not to be recommended if at all avoidable. The overload capacity of gas engines is very poor, they being the worst prime movers in this respect. The characteristics of gas engines render them quite unsuitable for use in parallel with electric motors.

The necessity for rapid reversal of the rolls will be appreciated from what has already been said regarding the importance of maintaining as high a mean temperature as possible in the metal during rolling. In Table II are shown the times of reversal of several modern electrically-driven rolls of the R.P.M. stated. The number of times the rolling cycle can be completed per minute is also given :—

TABLE II.

Reversal from	Is effected in	The rolling cycle being completed
± 120 revs. per min.	6 seconds.	7 times per minute.
± 110 "	4½ "	12 "
± 100 "	2½ "	14 "
± 90 "	2 "	15 "
± 60 "	1½ "	28 "

The statement that electric motors are inferior to steam engines in rapidity of reversal and acceleration cannot be justified, and in any case would be purely a matter of the horse-power and starting torque of the motor installed and the inertia to be overcome.

(*f*) *Fly-wheel Use and Design.*—The fly-wheels used in rolling-mill installations present problems of design exactly akin to those met with in the design of colliery winding, balancing fly-wheels. Only the best material, usually cast-steel or forged nickel steel, must be used, and it must be run at as high a peripheral speed as possible. Built-up fly-wheels made from layers of armour-plate have proved in

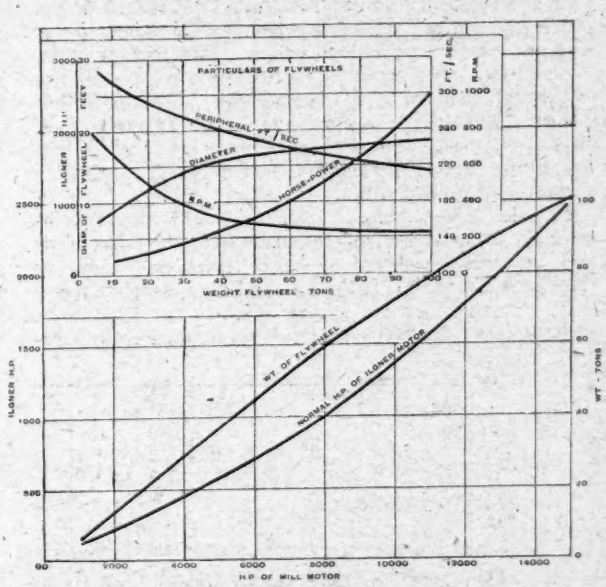

FIG. 3.—PARTICULARS OF FLY-WHEEL WEIGHT, ILGNER MOTOR H.P., &C.

many respects more satisfactory than simple castings for the largest wheels. Owing to the difficulties and risks of manufacture of large wheels, two small ones are sometimes employed in place of the equivalent single wheel. The moment of inertia obtained per ton of metal is then reduced, the only advantage of the process being simpler and safer construction.

A recent American design for large fly-wheels consists in the dovetailing of thin sheet steel stamped sectors to a suitable cast-steel spider. The overlapping points of the stampings are staggered layer to layer, and the whole is bolted between massive steel cover plates. Failure of such a wheel owing to unobserved defects of material is very improbable. The largest wheel yet built on this principle weighs 200,000 lb., is of 168,500 ft.-lb. units of moment of inertia, and is run at 258 ft. per sec. peripheral speed. An added advantage in the use of twin fly-wheels in cases where the load factor is very variable is that it is sometimes possible to disconnect one or both wheels when the maximum demand does not exceed the output of the Ilgner set motor. The bearing and windage losses of the fly-wheels are thus avoided and the accelerating periods considerably reduced. The curves of fig. 3 show the usual weights of fly-wheel for various horse-powers of main motor, and, inset, the horse-power of Ilgner motor required to drive the fly-wheel, and

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the diameter, R.P.M. and peripheral speed of the latter. The fly-wheel shaft must be of the most careful and liberal design and manufacture, and, as a tentative value, its diameter may be made = D in. $= 3\sqrt[3]{\frac{W \cdot S}{2}}$, where W = weight of fly-wheel in tons; S = bearing span in feet.

The excessive weight of balancer fly-wheels, together with their relatively high R.P.M., necessitates very special bearings. The simple bush type, lined with white metal and designed on the basis of a very moderate pressure per square inch of bearing, is most satisfactory. Forced

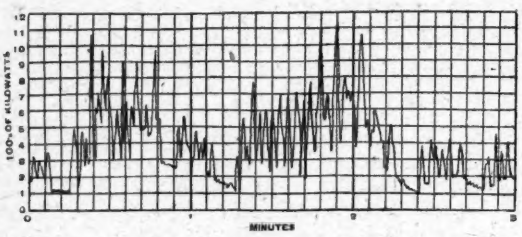


Fig. 4.—Rolling Mill Load Curve.

lubrication, by gravity or by an oil pump, is necessary, and a hand pump should also be fitted in case of failure of the ordinary system of lubrication, which failure should be at once and unmistakeably indicated to the attendant by an alarm device. The enclosure of fly-wheels in metal casings considerably reduces their windage losses, and, to further this end, their surface should be as smooth as possible. A plain disk wheel is the best as regards low windage loss. Exhausting the enclosing casing, though beneficial, presents obvious practical difficulties.

In order that the kinetic energy of the fly-wheel may be available to assist the rolling motor over the peaks of its load, it must be slowed down by some means on the occurrence of a peak. If the fly-wheel is on the main motor shaft, this necessitates a fall in speed of the main motor, such as is automatically obtained in accumulatively compounded D.C. machines or in three-phase machines when resistance is inserted in their rotor circuit. Otherwise the fly-wheel is compelled to slow down, meanwhile adding its kinetic energy to the main supply of energy through the intermediary of an auxiliary generator to which it is coupled, as in the Ilgner system.

Where three-phase motors are used, the rotor resistance, introduced to cause "slip" when desired, is obviously wasteful of energy. The waste may be reduced by decreasing the slip necessary, *i.e.*, by increasing the weight of fly-wheel used, and for maximum economy the interest on the capital cost of the fly-wheel plus the money equivalent of the energy wasted in the rotor resistance must be a minimum. The use of automatic slip resistances affords some saving in this respect. Such a resistance is only switched into circuit when the demand from the mains exceeds the desirable predetermined value, and thus the loss of energy in the rotor resistance during light loads is avoided, and the fly-wheel is enabled to speed up again more rapidly after a high load period, but it must be remembered that during the high load periods in which the major part of the losses occur, the rotor resistance is of necessity still in circuit. Though it cannot be definitely stated whether, in general, automatic slip resistances are good or bad, the extra complication they involve frequently only results in a gain of efficiency of 1 per cent. if the maximum load periods are frequent; if they are separated by fairly long light load runs, the saving is of course considerable. As regards the percentage variation desirable in the fly-wheel speed, this varies from 7 to 15 per cent. in most cases, the kinetic energy available being directly proportional to the difference between the squares of the initial and final R.P.M. The average horse-power available from a fly-wheel of weight W tons running at a maximum peripheral speed v ft. per sec. and retarded from angular velocity w_0 to w_1 rad. per sec. (where $w_1 = \frac{1-p}{100} w_0$) in a period of t seconds is given by—

$$\text{H.P.} = \frac{W v^2}{316{,}000 \times t} (200\,p - p^2) \quad . \quad . \quad . \quad . \quad (1)$$

(*h*) *Batteries as Load Equalisers.*—A study of the load curves shown in figs. 4 and 5—typical of rolling-mill practice—and an appreciation of the enormous magnitude of the variation in demand, will explain and justify the statement that electro-chemical storage is quite unsuitable for equalising such loads. The life of secondary cells in such a service, subjected to great overloads both of charge and discharge, is very unsatisfactory. It is, of course, not impossible to use chemical storage, but the cost of so doing will, in most cases, far exceed that of storage on any of the well-known electro-mechanical schemes (Westinghouse, Siemens-Ilgner, Creplet-Lahmeyer, &c.). The Iffland system is typical of those employing a "floating" battery to aid the main generator, and, apart from the above inherent disadvantage, has the advantage of avoiding friction and windage losses, while the battery will serve as the sole source of energy for a short period in case of breakdown in the normal supply circuit. Such duty as the latter is, however, very destructive to the battery. The efficiency of electro-chemical storage, especially on short alternate charge and discharge, is very high, being frequently over 95 per cent.

In the mills of the Carnegie Co. there has recently been installed a battery of 125 secondary cells having 10,000 amperes normal discharge current with an output of 15,000 amperes over short periods.

In general there can be no doubt that electro-mechanical is preferable to electro-chemical storage, in spite of the difficulties involved in the manufacture and running of sufficiently heavy wheels, and, electrically, in voltage control and the elimination of sparking. The use of commutating poles and Deri windings has enabled direct-current motors to be run sparklessly, even with such variations of load as are shown in figs. 4 and 5.

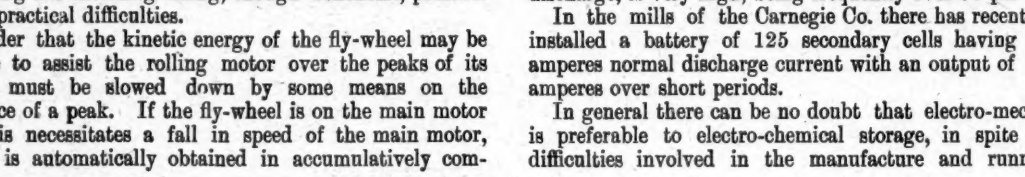


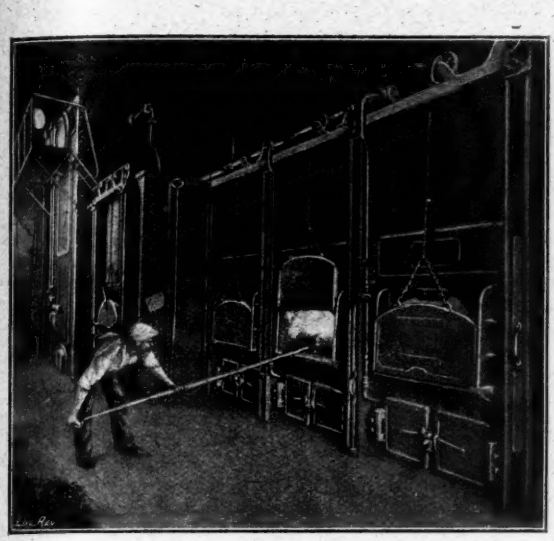
Fig. 5.—Typical Rolling Mill Load Curve.

When designing rolling-mill equipments it is necessary to ensure compactness of arrangement while preserving easy accessibility for repair, substantial and shock-resisting construction and easy, simple and safe control, preferably from an elevated platform, whence the whole machinery controlled can be overlooked. All these desiderata can be much more readily fulfilled in electrically-driven than in steam-driven installations.

A 100,000-volt Sub-station.—The Denver sub-station of the Central Colorado Power Co. is now complete. The oil switches and lightning arresters for the incoming 100,000-volt lines are located some distance from the main building, and the pumps for the transformer oil-cooling are also in a separate building at the edge of a small creek. The main building is used for purely sub-station purposes, and is without a pound of combustible material in its structure; and a transformer oil fire is the only possible damage. This, however, is safeguarded against by every possible precaution, and the tanks are so arranged that the transformer room can be flooded with carbonic acid gas in case of necessity.—*Electrical World.*

ASYNCHRONOUS PLANT AT THE PRAHRAN (VIC.) DESTRUCTOR.

The asynchronous generator, although discussed in text-books on electrical generating machinery and now and then noticed in the electrical journals, is rarely met with in



Prahran Destructor, showing the Cells.

practice. Very soon after the introduction of the asynchronous or induction type of alternating-current motor, proposals were made and patents taken out for the use of these machines as generators under various arrangements, but for reasons not easy to discover the method has been seldom applied. Advocates of this type of generator, however, from time to time make themselves heard, and quite lately an excellent paper was read by Mr. W. L. Waters before the American Institute of Electrical Engineers, again drawing attention to the type and expressing surprise at the neglect of its good qualities. One of the latest notices of an asynchronous generating station in actual operation appeared last year in the technical papers in a description of an hydraulic installation on the Rheinbinnenkanal, Switzerland, in which two asynchronous generating stations are run in conjunction with, but at several miles distance from, the master synchronous station. Two important characteristics may, after all, explain the apparent neglect of this type of generator. These are, first, its somewhat low power factor; secondly, its incapacity to generate unless running in conjunction with a synchronous generator; where the choice lies between such a set and one which can independently generate the station engineer will naturally prefer the latter. There are, however, conditions in which the characteristics of the asynchronous generator are of special value; hence a description of an installation lately completed in Australia may be of interest.

The Council of the City of Prahran, the largest suburb of Melbourne, with a population of 43,000, decided to erect a refuse destructor, and an order was ultimately placed with Messrs. Meldrum Bros. for two independent units of their Simplex type. As the refuse to be burned varied between 20 and 35 tons per day, and averaged throughout the year 26 tons per day, it was evident that a good deal of waste heat would be available, and accordingly a Babcock water-tube boiler of 1,426 sq. ft. heating surface was incorporated in each unit. A portion of the steam generated was reserved for operating a mortar mill, and a clinker-crushing and grading machine, as well as for use with the feed pumps and forced draught, and it was decided to use the remainder in the generation of electricity for sale. Before deciding as to the generating plant to be installed, careful consideration was given by Mr. Calder, the city engineer, to all the conditions surrounding the proposed supply, with the result that the following desiderata were formulated :—

(*a*) Before all else, it should be recognised that the destructor was a destructor of refuse, and not a power house for the supply of electricity to consumers. Complete destruction of the refuse was the primary consideration; the generation of electricity a secondary one only.

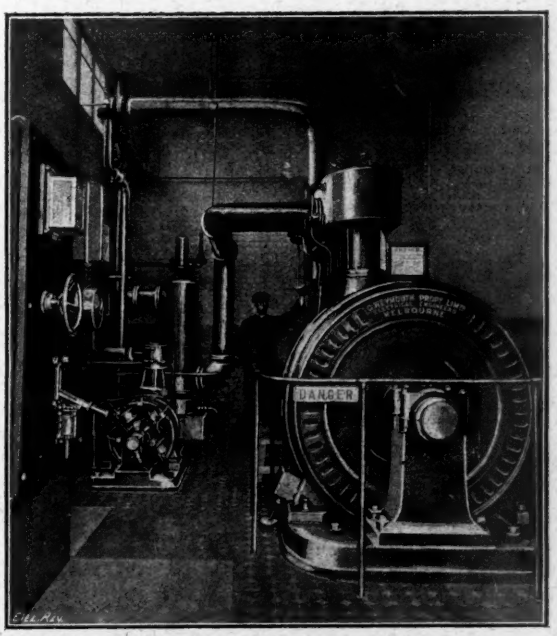
(*b*) The consumer of electricity supplied from a destructor should not prescribe to the Council the rate at which electricity should be supplied or the times when it should be available, for the requirements of the ordinary consumer would be inimical to the proper operation of the destructor as a destructor, and lead to considerable waste of steam. Hence the ideal consumer was one who would provide, as it were, an "electric sink," into which the destructor could pour its by-product when and as fast as made, and who would not grumble even if, at times, no supply were forthcoming.

(*c*) The generating machinery must be so arranged that the output would automatically follow the ever-varying rate of steam production as closely as possible.

(*d*) In order to save labour, which in Australia is an important item, the machinery should be as automatic and simple in operation as possible, so that the existing staff at the destructor could operate it without difficulty.

The ideal consumer was found in the Melbourne Electric Supply Co., the electric undertakers for Prahran and the surrounding suburbs, who undertook to provide the "electric sink" required under Condition (*b*). They, however, stipulated that the destructor staff, naturally unskilled in electric supply, should not find it necessary to undertake the somewhat delicate operation of synchronising their generator on to the company's mains, and this stipulation, coupled with the requirements of Conditions (*c*) and (*d*), led naturally to the choice of an asynchronous generator.

The company's system, covering an area of over 40 square miles, distributes by single-phase alternating current, 50 cycles, at a pressure of 4,000 volts. (For a description of this undertaking, see our issue of July 9th last.) The Council's asynchronous generator was, therefore, built for this pressure, by Messrs. George Weymouth & Co., Melbourne, and has a maximum output of 125 kw., an efficiency of 88 per cent., and a power factor of ·87. The alternator is direct-coupled to an Allen non-condensing compound engine, running at 375 r.p.m. Synchronising gear is, of course, absent, but in order to keep down rushes of current



Interior of Engine Room, Prahran Destructor, showing Weymouth Asynchronous Generator.

on switching-in, a choke-coil with movable core has been fitted, which reduces the pressure across the stator windings to about 2,000 volts. When switching in, the machine is run up to just over synchronous speed, and the oil switch closed through the choke coil; it is easy to keep the current rush down to about 18 amperes, the core of the choke coil being naturally withdrawn and the coil short-circuited as soon as switching in has been effected.

The perfectly automatic operation of the generating set is obtained in the following manner :—The shaft governor of the engine is so adjusted as to be quite inoperative at ordinary working speeds, which at 50 cycles and about 1·35 per cent. slip, lie between 380 R.P.M. at full load and 375 R.P.M. at the point of no load—*i.e.*, just before the generator ceases to generate, and becomes a motor. The pressure at which the boiler safety valves are set to blow off is 200 lb. ; but in order to take advantage of what thermal storage effect would be obtainable in consequence of the mass of water in the boilers, it was specified that the engine valves should be so set by the manufacturers that the full-load torque on the shaft, equivalent to the maximum load of 125 KW. at full-load speed, should be obtained with steam at a pressure of 150 lb. per sq. in. at the fully opened stop valve, the shaft governor, as mentioned above, to be inoperative. In the steam pipe, therefore, a reducing valve has been inserted, and carefully adjusted under actual running conditions. It is interesting to note that the setting of the valves was so well predetermined that the above conditions were found to be satisfied when the reducing valve was set for 146 lb., a very small deviation from the specified figure. With this arrangement, tests have shown that the steam pressure may vary from 200 lb. down to about 35 lb. at the boiler with fully opened and untouched engine stop valve before the generator ceases to generate. In this manner perfectly automatic operation is secured, and in practice the engine is not touched during the run of about 10-12 hours per day. The output exactly adjusts itself automatically to the rate at which heat is at any time being passed through the boiler plates from the burning refuse, and only those who have had practical experience of destructors know how enormously variable this rate is. The following are some test figures :—

Frequency of current, 51 cycles, and pressure 4,400 volts, both fixed by the main synchronous generators in the power house, and a load of about 0·8 power factor.

	Amps.	Volts.	KW.	Power factor.	R.P.M.	Boiler pressure.	Pressure at stop valve.
Full load ...	35	4,400	125·1	0·8125	387	170	146
No load ...	13·75	4,400	—	—	382	175	35·7

In practice, reversal or motoring does not take place ; it is evident that a very small amount of steam is required to overcome engine and generator friction, and keep them running at no-load and synchronous speed. The only use made of the shaft governor is as a run-away governor, and it is set so as to come into operation at about a 10 per cent. increase of speed over the normal.

As regards output, the results obtained during the first two or three months of operation give an average of 42 units per ton of refuse ; no allowance has been made in this figure for the steam used for the air-blast, steam pumps, mortar mill and clinker crusher. Considering that the climate of Melbourne is responsible for a much smaller percentage of household grate ash in the refuse than obtains in English refuse, the result is not unsatisfactory. The choice of the asynchronous type of generator has thus been fully justified ; in consequence of its characteristics, special labour has been rendered unnecessary ; the destructor staff cannot interfere with the pressure or frequency of the general supply, and the power to create trouble during the delicate operation of synchronising has been taken out of its hands. The "electric sink" provided by the company, moreover, enables the Council to make profitable use of every ounce of steam generated, and there is no reason to either blow off steam or tamper with the proper working of the destructor in the attempt to conform to the ever-varying requirements of the ordinary consumer. The Council of Prahran and its engineer, Mr. Calder, may well be satisfied with the success of this somewhat unusual installation.

An Aluminium Understanding.—It is stated that the principal producers of aluminium have now arrived at an understanding only to proceed with sales for deliveries until the end of next March. The makers include the Neuhausen Aluminium Industry Co., the French works, with the exception of a small factory, the American works and, it is said, the British Aluminium Co. It is believed in interested circles that the arrangement represents the preliminary step in the direction of reconstituting the international syndicate.

THE RELATION OF ELECTRICAL DISTRIBUTION TO STREET TRAFFIC.

By A CIVIL ENGINEER.

ELECTRICITY supply engineers who are interested in the design and lay-out of systems for the distribution of light and power are apt to discover that many of the problems presented to them are hardly those which can be combatted by the theoretical instruction, however sound, that they may have received in a technical college course. In very many cases the difficulties can only be met by an intelligent application of common sense, and in the design of distribution systems a considerable amount of foresight is necessary in order to avoid difficulties which upon completion would appear obvious to even the man in the street.

One of the great troubles which are found, more particularly in our larger cities, is the question of the extent to which street traffic will interfere with the installation of electric appliances. This does not merely apply to the interference which is caused to the easy installation of the plant in the first instance ; it may very easily affect the working conditions of the finished design. As the subject is of such importance from the point of view of the municipal engineer, it may be worth while elaborating the matter by noting one or two examples which have been actually met with in practice.

A very simple case, and one which, during the last year or two, has been brought very prominently into public observation, is the question of the location of arc lamp-posts for public street lighting. Undoubtedly the ideal system from the point of view of minimum obstruction to traffic is the placing of the arc lamps upon brackets secured to the premises on either side of the thoroughfare. This, however, involves two difficulties, one being the fact that it is in many cases difficult to obtain permission from the owners of such premises for the support of the brackets, except at an exorbitant rental ; the other difficulty is that with a system of street lighting from lamps situated at a distance from the centre line of the thoroughfare the light distribution upon the street is likely to be unequal, and a larger number of lamps per mile is required than if they were placed along the middle of the thoroughfare. The first difficulty is partially got over by mounting the arc lamps on standards placed close to the kerb. By the use of brackets on these standards, projecting over the roadway, a closer approximation to central lighting is obtained, but at the same time obstruction to passenger traffic is caused by the bases of the poles, and this is aggravated in many cases by the unwieldy proportions which the bases often assume due to mistaken notions as to ornamental design. In many instances the side-post construction has been abandoned, more particularly in wide streets, and centre poles have been placed in the middle of the thoroughfare. This arrangement gives the best possible distribution of light, but except where the street is a main thoroughfare of considerable width, the obstruction to horse and motor traffic is of very great importance. Where such a construction is adopted, it should be noted that every arc lamp-post should be protected from collision with vehicular traffic by means of an "island" raised some 6 in. above the surface of the roadway, and protected by hard stone kerbing. Even with this protection it has been found in the Metropolis that collisions caused by motor-omnibuses, which have a tendency to skid on slippery road surfaces owing to their great weight, have been very frequent, and means have been sought to avoid this trouble by some other means of suspension. One of the modes suggested, which appears to be meeting with favourable consideration, is the fixing of small rosettes in the walls of premises adjacent to the thoroughfare, from which steel span-wires are taken at the centre of which the arc lamps may be slung. The annual rentals for such rosettes would be smaller than those required for brackets, although it must be ascertained that the buildings to which they are fixed are structurally strong enough to withstand the heavy strain of the span wire.

In cases where the side-post type of lighting is adopted, which is the most common solution of the difficulty at present, great care should be taken to see that every lamp

column is placed at the statutory distance away from the edge of the pavement, as where this point is neglected any claim for compensation for damage caused by the knocking-down of such columns by vehicles in foggy weather or where the roads are greasy will be nullified.

The question of trimming the arc lamps has a very serious bearing upon the placing of arc lamps for street lighting purposes, and in some cases it would almost appear as if this point had been overlooked, or at any rate as if insufficient precaution had been taken to avoid accident. It is, for example, the custom in many cases where the municipality owns a tramway system to utilise the standards employed for supporting the overhead conductors for the purpose of giving a central system of street arc-lamp lighting, by placing the arc lamp on the top of the pole bearing the brackets for the conductors. This in itself is quite a sound construction so long as care is taken to select a type of arc lamp whose steady effect is not interfered with by the vibration due to the periodical passage of car trolleys. In some instances, however, owing to the narrowness of the streets, or to an attempt to economise on first cost, the tracks are laid so close together that very little clearance is left between the side of the car and the column; where this is the case the arc-lamp trimmer is given a narrow ladder which he has to plant with great exactitude against the column, and the clearance between the edge of the ladder and the side of the passing car in some instances is only a fraction of an inch. It is obvious that a very slight error of judgment in such a case would cause a very nasty accident, should a passing car knock the ladder away when the trimmer is engaged in putting in new carbons or cleaning the lamp. Even where due precaution is observed as to the clearance of tramcars, it does not follow that safety is ensured to the arc-lamp trimmer. Some little time ago in the metropolitan area an arc-lamp trimmer was very seriously hurt owing to the fact that he was working on the top of a ladder provided with wheels, used for trimming street arcs. A passing 'bus skidded and collided with the ladder, bringing the man to the ground. Fortunately there was no loss of life, and only minor injuries to the man, but the injury so upset the man's nerves that he was afterwards unable to carry out such work, and the result might easily have been still more serious.

The subject of interference with electricity supply owing to street traffic does not, however, end with the question of arc-lamp columns. The switch pillar, which is frequently adopted in order to give adequate space for the housing of tramway and other switchgear without incurring cost of excavation work, comes under precisely the same category as the arc-lamp columns as regards obstruction to traffic, more especially as the switch pillar often contains a large amount of apparatus and heavy connections, and must therefore either be of large dimensions or else have very cramped internal arrangements. The tendency is to place such switch pillars as near to the edge of the pavement as ever possible, in order to avoid obstruction to passenger traffic. This, however, has its danger. In one instance a switch pillar placed right on the edge of the pavement in a main thoroughfare had one of its sides smashed in by the wheel of a passing cart. The cart in drawing up to the kerb completely broke in one side with its wheel, as the cover was made of cast-iron only $\frac{1}{8}$ in. thick. The broken side fell inward and came in firm contact with a live terminal, making the whole framework alive and rendering any passer-by liable to shock. Fortunately the voltage of this terminal was only 200, but the matter was sufficiently serious to show the danger of placing such a post in a position where it was liable to vehicular concussion. In order to remove the danger of shock to pedestrians the broken side was lifted out, and wooden planks were wedged into place to serve as a safeguard against the inquisitive small boy until the pillar could be properly repaired. The question of constructing such pillars of mild sheet steel is worthy of some consideration.

The increasing weights of carts, lorries, &c., which are now coming into vogue, owing to the greater use made of petrol tractors, bring in their train the necessity for the reconsideration on the part of some electricity supply authorities of the design of the street service boxes which are used at corners of thoroughfares and other exposed positions for the purpose of connecting and inspecting the cables running in the streets. The usual urban by-laws provide for the burying of cables at a sufficient depth or their protection in some other approved way, to provide against disturbance due to the passing of heavy traffic; and up to the present the limits of safety in this direction have not yet been reached by the increase of size of traffic units. The weakest part of the system is, however, as may readily be imagined, at the point where the electric connections are brought nearest to the surface, that is to say, at the junction and inspection boxes, and it would be well for electrical manufacturers to examine their designs in view of the more stringent requirements which are now made necessary owing to the increase in weight of the traffic. As a case in point may be mentioned a fracture of a street box containing low-tension fuses, which had its cover entirely broken up by the wheel of a heavy traction engine. Pieces of the cover fell into the interior of the box, but the apparatus was fortunately protected by a glass lid, preventing earth contact being made. Fortunately this glass did not break at the time of impact. In order, however, to protect the street box from subsequent injury, a temporary repair pending the replacement of the cover had to be made by letting in a paving stone of the required size flush with the road. The lesson to be learnt is that such expedients should not become necessary, and that in order to meet the case designers should take pains to construct their street boxes with a very large factor of safety, in spite of the severe competition which at present undoubtedly exists between makers of such apparatus.

It will sometimes be found that even when considerable care has been taken in the design and construction of electrical apparatus, and due regard has been given to the probable conditions under which it will have to be worked on the part of the manufacturer, his efforts are nullified by oversight on the part of a district authority or other governing body of such a simple matter as the influence of traffic conditions. Numerous cases of this kind can be mentioned, but it will be sufficient to typify them all by one example which will sufficiently indicate the nature of such trouble. A certain urban supply authority has erected a small sub-station on the corner of a road at the foot of a fairly steep hill. This station is a static transformer station for the purpose of converting from a high-tension supply at 3,000 volts to a low distributing pressure. It contains not only transformers, but also high and low-tension switchgear, the necessary bus-bars and connections. All this apparatus is of good design and thoroughly adapted to the work for which it is intended. The sub-station, however, which is made of cast-iron structural work, the plates being about $\frac{3}{16}$ in. in thickness, is situated above ground on the edge of the pavement, this being a fault in location which will sooner or later almost inevitably induce a most serious accident. It is quite possible that on some occasion a vehicle will fail to turn the corner and will almost certainly crash into the station. It is quite conceivable that under such circumstances the broken metallic side of the sub-station may rest on the high-tension plugs, and the results to the curious crowd which will inevitably collect would be too terrible to be imagined with equanimity. It may be argued that this is rather an exceptional instance of short-sightedness in the location of electricity distribution and utilisation devices, but it will probably be found that a good many instances of inattention to traffic conditions can be found in a considerable number of the supply systems operating in congested areas. The consideration of traffic conditions in electrical plant design will therefore probably be worth the attention of our engineers in a more marked degree than at the present time is apparently the case.

South African Trade.—There are signs of improvement in South Africa. Reuter's Cape Town representative says that the imports from the United Kingdom to South Africa have increased 2 per cent. during the past nine months. Foreign imports decreased 1 per cent., as compared with the corresponding period of 1908. "For the month of September the former show an increase of 4 per cent. and the latter a decrease of 5½ per cent. against September last. This is the first decided turn for several years."

WAGES IN THE ELECTRICAL TRADE.

The Labour Department of the Board of Trade has issued a report in which it is stated that the standard hourly rates of wages and usual working hours in a full week (exclusive of overtime) recognised at October 1st last by the Electrical Trades Union for its members in the undermentioned towns of the United Kingdom were as follows:—

District.	Electric fitters and wiremen.	Armature winders.	Cable jointers.	Instrument and switch makers.	Weekly hours of labour.
England & Wales.	d.	d.	d.	d.	
Barrow	8	8	...	...	53
Birmingham ...	8½	9	9	8	53
Bolton	8½	9	...	...	50
Bradford ...	8	8	9½	...	50* 54†
Bristol	8	...	...	...	...
Cardiff	9	9	9	...	54
Hull	8	9	9½	8	53
Leeds	8	8	10	...	...
Leicester ...	8½	8½	8½	8	53* 54†
Liverpool ...	9	9	9	9	50* 53†
London	9½	9	9½	9	54
Loughborough ...	8½	33s.‡	...	...	52½
Manchester ...	8½* / 8¾†	8¾	8½	37s ‡	49 to 53* / 53†
Middlesbrough ...	8	8	...	...	53
Newcastle ...	8	8	...	...	50* 53†
Norwich... ...	8	...	8	...	54
Nottingham ...	8	8½	7½	8	54
Oldham	8½	8½	...	...	52
Plymouth ...	36s.‡	36s.‡	36s.‡	...	48§ 54‖
Portsmouth ...	36s.‡	36s.‡	36s.‡	...	48§
Preston	8½	36s.‡	8½	...	50
Sheffield ...	8½	8½	8½	8½	50* 53†
Southampton ...	8	8	8	...	54
Southport ...	8½	...	8½	...	49½
Sunderland ...	8	8	8	...	53
Wolverhampton	8	8	8	...	53
Scotland.					
Aberdeen ...	7 to 8	8	...	...	51 to 54
Edinburgh ...	8	8½	...	...	51
Glasgow... ...	8	9	8½	...	54
Ireland.					
Belfast	8	8	8	...	54
Dublin	8	...	9	...	54

* Building trade. † Engineering trade. ‡ Per week.
§ Dockyard. ‖ Town.

THE "E.I.C." COAL TROLLEY.

In many public institutions, such as schools, workhouses, hospitals, and in small and moderate-sized electricity works, pumping stations and factories, it cannot be arranged to have every pound of coal

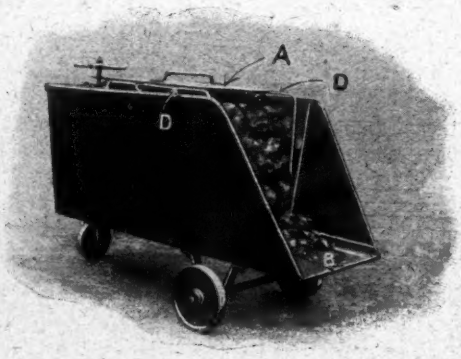


Fig. 1.

weighed, and there is no simple method of knowing day by day how much coal has been consumed. The stock which remains at any given time is difficult to estimate in the rough pile, and no reasonable statistical accuracy is practicable. To get over this difficulty a new coal trolley has been devised by Mr. Chas. A. Clarke, superintendent engineer of the Brentford Union.

This trolley is intended specially for the conveyance of coal from the pile to the boiler-house floor. It is a plate-iron box, open fronted, as shown in fig. 1, but the sides near the front end have a vertical sliding way, in which slides a shutter plate. At each side there is fixed also a round bar, bent to the outline of the trolley front and top edges, and these bars pass through a pair of eyes on the closing shutter. When the closing shutter is lifted so as to open the front of the trolley, it cannot be removed from the trolley, but can only be laid horizontally as a cover above the coal.

This movable slide is shown lying on the top of the trolley in fig. 1 at A; the restraining bars are seen at D D, while the upper horizontal part of each bar is visible in fig. 2.

The trolley has two leading wheels, and one trailing or steering wheel carried on a vertical bar at the back of the trolley, the bar being fitted with a T top, as shown, and with a locking pin at C. When being moved, the wheel is free to roll in the same direction as the front wheels, but when at rest on the boiler house floor, the

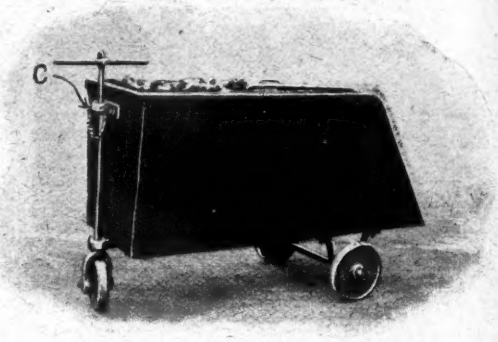


Fig. 2.

T handle is turned through 90°, and the wheel is set across, as shown in fig. 2, and locked in this position. The slide is raised out of the guides, and the front platform B, fig. 1, forms an excellent shovelling floor. The coal is not emptied out on the floor, but is shovelled directly from the trolley, which is now prevented from moving by the transverse position of the back wheel.

The dimensions of the trolleys so far made are such as to admit of 6 cwt. of Welsh coal broken down to proper firing lumps being shovelled into it, and experiment has shown that the accuracy is such that in a mass of 42 tons of coal, there was not found a discrepancy of more than 8 cwt., or less than 1 per cent., while a trolley taken at random was weighed and found correct within 2 lb.

It is necessary with different deliveries of coal to find whether the usual filling gives a weight differing from 6 cwt. If so, then the trolleys are so rated, but such check weighings need not be very frequent, and meantime, the weight once ascertained, it is only necessary to check the number of trolleys filled for a very close approximation to the coal consumption to be known. The position of the slide A on the top of the trolley prevents the filling of the trolley, and the slide is so easily run into position that there is no reason why it should not be.

The work of the fireman is rendered easier, because he has several inches less to stoop for each shovel of coal, and the platform B is smooth and easily shovelled from. An additional advantage is that the boiler-house floor is kept clear of fuel, and cleanliness generally is promoted, but these are all incidental to the particular object sought—namely, the checking of the fuel to within 1 per cent., which can be secured by an occasional test weighing of a loaded-up trolley to find if the coal bulks the same weight.

It is particularly claimed for this trolley that it obviates the dumping of coal in the boiler house, with the attendant dirt and dust. Three sizes are proposed to be made, of 4, 5 and 6 cwt. capacity, according to the coal consumption and the condition of the floor or roadway along which the trolley will be drawn, and its inclination to or from the boiler house.

The trolleys are made by Messrs. Pryke & Palmer, of Upper Thames Street, E.C., who are placing them on the market as the E.I.C. or Engineers-in-Charge Trolley.

While primarily intended for coal, the trolley is also useful for other approximations, as, for example, in mixing aggregates, sand and cement for concrete on extensive works.

American Telegraph Combine.—According to *Telephony*, Clarence H. Mackay, head of the Mackay Companies, a corporation which controls the Postal Telegraph Co., and is the largest stockholder in the American Telegraph and Telephone Co., when asked about the report that the Postal Co. had absorbed the Western Union, said that neither the Postal Co. nor the Mackay Companies had entered into any arrangement for the purchase or lease of the Western Union or the purchase of its stock, and neither the Postal Co. nor the Mackay Companies contemplated doing so. Competition would continue.

CORRESPONDENCE.

Letters received by us after 5 P.M. on Tuesday cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.

Power for Pioneers.

Re your article headed "Suction Gas as a Power for Pioneers," I should like to point out that it would be well-nigh impossible to transport a suction gas producer miles up country or in the back-woods, as it is now constructed, and a great question arises—Where are the pioneers to get the anthracite from? Surely the old "cranky" steam engine has the pull, as wood or any similar fuel would be easily procured and equally easy to burn in any boiler; but when the suction gas producer is designed to burn any class of bituminous coal or dross, then a wide field is surely opened up for that power which is wrongfully called "suction" gas.

R. V. Farnham.

Skelmorlie, *October 29th*, 1909.

A Question on Load Factor.

In reply to "Ratio's" letter under this heading, provided that the battery is fully charged each day from the generators during the time they are running, he will certainly be quite correct in assuming the station capacity at 200 kw. A station load factor, however, is usually reckoned on a 24-hour day basis, the actual hours of plant run only being taken into consideration in arriving at running plant load factor.

Return.

Train Lighting.

Regarding "Railway's" inquiry on page 688 of your issue for October 29th:—

(1) The G.W. Railway have, or had, one Moscowitz installation;
(2) The Leitner system has been adopted on the G.W. Railway;
(3) Turbo-generator sets on the locomotive are, or were, used in Belgium, the system being known as the Pieper & l'Hoest.

Lighting.

[Curtis turbo-lighting sets have been adopted as standard for the Chicago, Burlington and Quincy Railway's suburban traffic; see Elec. Rev. p. 864, May 21st, 1909.—Eds. E.R.]

The Possibilities of the Electric Vehicle.

With reference to your leading article in last week's issue, we have been endeavouring for some time past to interest the large business houses in London with a view to their adopting electric vehicles for parcel delivery.

Messrs. Peter Robinson, Ltd., hired one of our 15-cwt. electric delivery fans. During one week the distance covered was 204·8 miles, and the total number of units consumed for charging the batteries was 187·5. With energy at ¾d. per unit, this works out at ·68d. per van-mile run. The batteries are of the Tudor type, and their maintenance is undertaken at a cost of 1·2d. per van-mile run.

We shall be pleased to furnish full particulars to those interested.

F. A. Wilkinson & Partners, Ltd.,
F. A. Wilkinson,
Managing Director.

Harpenden, *October 27th*, 1909.

Refrigerating Plant.

With reference to the article on "Refrigeration" in your issue of October 22nd, I should like to say a few words.

In the main, there is little to criticise from a refrigerating point of view, especially in those parts dealing with generalities. They are concise and treat the subject skilfully. On certain points, however, it seems to me your correspondent has been misinformed.

First, as cold accumulators have been in use in cold storage (in a greater or less degree) ever since brine has been the cooling medium, it might have been advisable to leave out the name of the Pulsometer Co. as introducing the system. At least half a dozen firms were in front of them, each with an equally ingenious system.

Secondly, in publishing a table of capacities and powers, why select the very youngest of all the refrigerating firms for this honour? What have the dozen reputable firms done that they were not consulted, so that the table could be checked and the results be more accurate? The actual curve of powers is much steeper than that given.

A man with a store of 350 cb. ft. would be cross if told he required 2 B.H.P. to run his machine. He would says that at that rate he would have little advantage, if any, in cost over cooling by ice. The difference between 2 B.H.P. and the actual 1 to 1¼ at 2d. per unit would be great at the end of the quarter. Again, there are few machines chilling and maintaining 9,000 cb. ft. at 34° F. which only absorb 8 B.H.P.

It also appears to me to be a mistake to publish a statement that £90 will cover a man's outlay on a plant for 800 cb. ft. at 34° F. Nobody expects to get a plant at this price except at cutting rates. A manufacturer must have some profit, and surely enough cutting has already been done. "Cheap and nasty" is undoubtedly the term for this plant running 24 hours a day and then not satisfying the buyer. The machine is, however, sold from the maker's point of view, and the six months' guarantee time soon passes. The repair bill may recuperate him. On the other hand, many firms have gone under as the result of such tactics; those who ask reasonable prices are respected—and busy, too.

Most people are prepared to pay a fair price for a good and lasting article, but can this be said of a £90 plant?

There is, it is said, room for everyone at the top of the tree, and it should be the aim of every manufacturer to get there.

William Bell.

London, S.W., *October 26th*, 1909.

Finance and Industry.

Although not an inventor, I thoroughly sympathise with Mr. S. W. Martyn regarding the hopeless task of introducing any new idea to the electrical trade. This is partly due to the fact that wiring and installation work is so largely in the hands of ex-plumbers and men whose technical training does not allow them to judge of the merit of any new idea. I was recently called in to report on a 30-light job carried out by one of these men styling himself electrical engineer. My client had experienced a severe shock when standing in his bath and touching the wall, the pressure being 220 volts. The wiring was in conduit, and where the bend should have been the wire was simply taped with black tape and plastered over. Not a single bend or elbow or tee-piece could be found in the whole installation; yet this man does most of the builders' wiring work in the district!

No idea but "cheapness" would appeal to such a man. We have qualified registered plumbers; why not qualified and registered electrical contractors?

How few electrical contractors are able to give a customer any information regarding anything out of the ordinary run of things!

Six supply houses were recently asked to quote for an electric water-heater for bath-room use; only one was able to do so. In another case, a client asked a round dozen contractors to give particulars of an electrical water steriliser and filter, such as are very largely used abroad; not one of them could give him any details or even knew the apparatus. A firm of sanitary engineers were approached, and at once gave full particulars.

Until the electrical trade wake up, they must be content to see the German and American people run away with the plums, as they did in the early days of polyphase plant, and are still doing with colliery and electrical winding plant.

Flashlight.

The Coefficient of Self-Induction.

In reply to your reviewer's request for references, we may mention the following as typical:—Kapp, "Dynamos, Alternators and Transformers," 3rd German Edition, Chaps. xvi, xvii; S. P. Thompson, "Dynamo-Electric Machinery," Vol. II, pp. 18, 19, 21, 592; Steinmetz, "Alternating-

Current Phenomena," throughout; A. Russell, "Alternating Current," Vol. II, pp. 299-301.

We fear that further correspondence will not bring us nearer to an answer to the question raised in our first letter, and we do not propose to continue it.

Before closing, may we ask any interested reader to look at our first letter, and then to study the following propositions, which we would especially commend to the earnest consideration of practical engineers and designers :—

1. It is practically impossible to calculate the self-inductance of copper coils near masses of iron.—October 1st.
2. Even if the calculation of Proposition (1) were possible, it would be a far too complicated function of the current to be of any use.—October 1st.
3. The coefficient of self-induction cannot be used in a vector equation at all.—October 15th.
4. When there is iron in the core of a coil, the ratio of flux to current is a double-valued function of the current (*sic*).—October 15th.
5. It is unnecessary for scientists to assume the humiliating attitude that approximations are necessary.—October 29th.
6. The idea of calculation by equivalent sine waves was exploded some years ago.—October 29th.
7. If the wire of a coil be infinitely thin, the inductance is infinitely great, whatever may be the shape of the coil.—October 29th.
8. If there is iron in the neighbourhood of a coil, the notion that the flux is proportional to the current is one which will appeal only to the simple ones of this world.—October 29th.

It is further stated of the approximations constantly made by every designer of alternating-current machinery, that "as it is absolutely impossible to calculate, even roughly, the magnitude of the errors introduced by these assumptions, the whole performance must remain a botching piece of work."—October 29th.

C. F. Smith.
William Cramp.

Manchester, *November 1st*, 1909.

Voltage of Country House Installations.

I am at present engaged by a firm who make a speciality of petrol plants for lighting country houses, and in all cases they recommend a 25-volt set; now this is contrary to my ideas, and I have ventured to suggest that we should be doing our clients justice in recommending 100-volt plants.

My objection to the 25-volt pressure is the unsteady light when the load on the accumulators varies; the considerable drop (D.P.) when the test is anything but infinity, or caused by dirty connection in lampholders, fuse boxes, &c.; that it is impossible to utilise the plant for heating, owing to the amperage required by even the most economical radiators, hot plates, water heaters or irons.

It has always been my idea that it would be preferable to put in a 100-volt plant, divide the lighting circuits into two equal parts, running back to the distribution board, and divide the accumulators in a like manner; this would enable the man in charge to change over, and light the more important parts of the house in the case of a temporary breakdown.

Re the heating, this I consider could be carried out with a certain amount of economy by running a separate circuit to 100-volt terminals on the board.

As regards the D.P., this surely would not be so noticable with the 50-volt circuit, and a steadier light would result.

As 50-volt metallic lamps can be obtained in a low H.C.P., I fail to see the reason for recommending 25 volts, and even when transforming from 100 or 200 volts, &c., have never suggested a lower voltage than 50 which has always proved satisfactory.

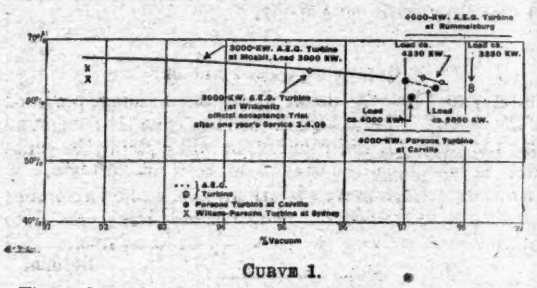
H. C. P.

[We quite agree that 25 volts is suitable only for small installations, where the distances are short and the load not great. A pressure of 50 volts affords a happy mean, requiring only 28 cells, while the current is nearly halved, and the percentage pressure drop in the leads is practically the same as at 100 volts. We doubt very much, however, whether the suggested division of a 100-volt battery, giving in effect a three-wire 50-volt system, would prove satisfactory in practice, without skilled attention to ensure the proper charging of the two halves of the battery. It is a simple matter to run heavy leads for heating circuits when required, and probably less costly than the method proposed by our correspondent.—Eds. E.R.]

Economy of Parsons and Impulse Turbines.

In an article entitled "Comparison of the Efficiency of Parsons (Reaction) and Impulse Turbines" (Electrical Review, June 25th, 1909, Vol. 64, No. 1,648, page 1062), the results of the steam consumption trials at Rummelsburg are contrasted with those of two Parsons turbines. The author comes to the conclusion that the Parsons turbines surpass the A.E.G. turbine in economy, but conducts his inquiry in such a superficial manner, that the strongest exception must be taken to his deductions.

The author suggests as the best basis of comparison for different turbines the *thermodynamic efficiency*, that is, the ratio of the steam consumption of the turbine in question to that of a theoretically perfect turbine working without losses and under identical conditions. According to him, this value for the 4,000-KW. A.E.G. turbine at Rummelsburg is not so great as for the 4,000-KW. Parsons turbine at Carville, nor for the 2,000-KW. Willans-Parsons turbine at


4000-KW. A.E.G. Turbine at Rummelsburg
3000-KW. A.E.G. Turbine at Mobill. Load 3000 KW.
Load ca. 4230 KW.
Load ca. 3250 KW.
3000-KW. A.E.G. Turbine at Wiskowitz official acceptance Trial after one year's Service 3.4.09
Load ca. 4000 KW.
Load ca. 3000 KW.
4000-KW. Parsons Turbine at Carville
A.E.G. Turbine
Parsons Turbine at Carville
Willans-Parsons Turbine at Sydney
% Vacuum

Curve 1.

Thermodynamic efficiency calculated on the load at generator terminals

$$= \frac{\text{Theoretical steam consumption per KW.-hour of a machine running without losses}}{\text{Measured steam consumption per KW.-hour.}}$$

Sydney (N.S.W.). Moreover, he states that with later Willans-Parsons machines still better efficiencies have been attained.

The following is a reply to these statements:—1. The efficiency of 68 per cent. which is given for the Parsons turbines at Carville and Sydney is not correct. The Carville efficiency is apparently taken from the published table ("Zeitschrift des Vereins deutscher Ingenieure, 1907," page 1122). The author has neglected to observe that this value is based on the load in horse-power, and has been obtained by dividing the value for the KW. by 0·93 (electrical and mechanical efficiency of turbine and generator). It is manifestly wrong to compare the thermodynamic efficiency of a turbine reckoned on a basis of H.P. with that of another turbine calculated from the load in KW.

The thermodynamic efficiency for Carville, when reckoned from the load in kilowatts, is, at 5,164 KW., 63·4 per cent.; at 5,059 KW., 62·2 per cent., or a mean value of 62·8 per cent. This is the value which should be compared with the Rummelsburg value of 63·9 per cent.

The trials of the Sydney turbine were conducted with unfavourable steam conditions, as follows (*Engineering*, 1907, page 752) :—150 lb. sq. in. boiler pressure; 145° F. superheat; 27½-in. vacuum (Bar. = 30") = 91·7 per cent.

If a drop in pressure of 15 lb./sq. in. is assumed to take place in the steam piping, the steam pressure at the stop valve will be only 135 lb./sq. in. The available heat contents in expansion from the pressure to the above vacuum is 338 B.TH.U. per lb., and the theoretical steam consumption :—

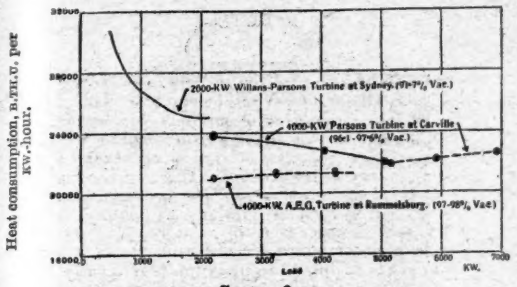
$$D_0 = 3{,}420/338 = 10{\cdot}12 \text{ lb./KW.-hour.}$$

Since the actual consumption (D) at 2,000 KW. is 15·5 lb./KW.-hour, the thermodynamic efficiency deduced from the electrical load is

$$\eta = D_0/D = 65{\cdot}0 \text{ per cent.}$$

2. The three turbines thus appear nearly equal. A comparison of the thermodynamic efficiencies is, however, not quite fair on account of the different heat drops utilised, and more particularly by reason of the different degrees of vacua. With the very high vacuum (from 97 per cent. to 98 per cent.) of which the A.E.G.

turbine in question had to make use, the specific volume of the steam at the exhaust end is so large that the steam velocities are very high, and consequently there is an appreciable exit loss, even when the blades are of the maximum permissible length. The efficiency with which the steam can be utilised is naturally thereby diminished. At 90 per cent. or 92 per cent. vacuum these disadvantages

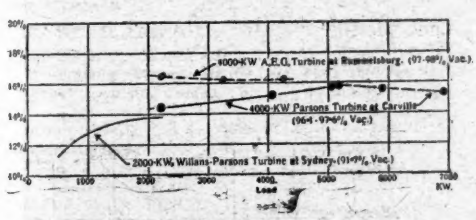


CURVE 2.

Heat consumption = Heat contents of live steam minus the heat contents of the feed water, the whole divided by the boiler efficiency of 0·75.

disappear, and higher efficiencies can be obtained. It is therefore necessary, in order to properly compare different turbines from the standpoint of thermodynamic efficiency, to select a method which takes this difficulty into account. The steam consumption, as is well known, decreases with increasing vacuum, but the attainable efficiency must also decrease, as is shown in the curve (fig. 1). On this curve is shown, in addition to the results of the above turbines, a series of actual measurements taken on a 3,000-KW. A.E.G. turbine in the Moabit station of the Berlin Electricity Works. These measurements took place in October, 1906, and were conducted to show the influence of vacuum on the steam consumption; the steam pressure was 192 lb. per sq. in. (absolute), and the steam temperature 600° F. (222° F. superheat). The results of the official trial of a 2,000-KW. A.E.G. turbine at Witkowitz are also given. This curve clearly shows that under equal conditions of vacuum, the A.E.G. turbine surpasses both the above Parsons turbines in thermodynamic efficiency.

3. While the thermodynamic efficiency is chiefly of interest to the designer and theorist, "thermal efficiency" is the station engineer's only true guide to the economy of



CURVE 3.

$$\text{Thermal efficiency} = \frac{\text{Electrical energy}}{\text{Energy in coal}},$$

his machinery, and when considered on this basis, the superiority of the A.E.G. turbine becomes still more marked. By thermal efficiency is to be understood the ratio of the energy actually produced electrically, to that contained in the coal or other fuel. If the boiler efficiency is assumed to be 75 per cent., and the feed temperature is equal to the temperature of the condenser (t_0), the heat corresponding to the coal will be:—

$$W = (i_1 - i_0)\, D/0{\cdot}75 \text{ B.TH.U.},$$

where i_1 = total heat contents of one pound of steam at the turbine stop valve,

i_0 = total heat contents of one pound of steam at the condenser,

and D = the steam consumption in lb. per KW.-hour.

The thermal efficiency reckoned from the coal to the electrical energy is then—

$$\eta_{th} = 3{,}420/W.$$

The loss by radiation may here be neglected. The values for the heat consumption and the thermal efficiencies are graphically depicted in the curves Nos. 2 and 3. These show in an explicit manner the undeniable superiority of the A.E.G. turbine.

The superiority of the A.E.G. turbine depends also on its ability to carry under continuous working conditions the highest steam temperatures; Parsons turbines are not able to do this. The steam consumption results, with such turbines, taken at low steam temperatures, are often reduced to the corresponding values at higher temperatures, in order to obtain better figures. Such a computation is evidently not permissible, when it has not been previously proved that the turbines in question can safely run under working conditions with such high temperatures.

The author is incorrect in his assertion at the conclusion of the above-mentioned article, that "up to now turbines of the impulse type have not been set to work, which have surpassed the results obtained on a commercial scale with turbines of the Parsons type," at least so far as the A.E.G. turbines are concerned.

On the contrary, there have not been, up till now, figures published to show that any other turbine has reached the economy of the A.E.G. turbines here mentioned.

The Electrical Co., Ltd. (A.E.G.).

London, W.C., *November 1st*, 1909.

Rose's Code Economiser.

In your "Telegraphic Notes" last week you referred to "Rose's Universal Code Economiser," and I feel it only just to myself to endeavour to correct the wrong impression which may possibly be conveyed by the fact that several important advantages claimed, and not embodied in other systems, have been overlooked. It is also somewhat unfortunate that eleven-letter words should have been chosen as examples, while omitting to mention that the section under which they are compiled is merely a supplementary one, provided in view of future developments, and with a range of no less than 64,000,000 code words.

May I ask that a few examples be chosen under Section C, applicable to any code word number from 0 to 159,999, which is well outside the range of the majority of recognised code books in present use. Take the four words—

PHRYGIANUL PHTHISIQUS IAPYGIORUN IASPACHATI.

The "cumbrous task" referred to (that of dividing the serial numbers of these words by 20 three times, allotting to the resultants their corresponding consonants as per key table, and inserting the connecting vowel U) I have just performed in considerably under two minutes, producing the words—

GUHUKUM GUHUKUR LUFULUM LUFUMUG.

I venture to assert that these four examples fully substantiate my claims, which are:—

1. Extreme simplicity, owing to the fact that the words handed in for transmission are of the same character, length, and pronounceability.

2. The certainty of immediate correction by the receiver, he merely having to lay out the signals representing the mutilated words and delete the Us, leaving the consonants originally transmitted.

3. The expeditious manner in which a message can be coded and decoded, my four examples, as above stated, having been compiled in less than two minutes.

4. The ease with which the system lends itself to rapid transmission by the operator, the position and frequency of the connecting vowel U being imprinted on his mind.

5. The economy to be effected by writing down the words continuously and ticking off the letters in tens for transmission.

6. The secrecy instantly secured by making one of the innumerable possible rearrangements of the key table.

In addition, the most suitable phrases can be selected from various code books and combined with catalogue matter, &c., without the necessity of using extra distinguishing text-words, each word being at once identifiable with its own particular code book, catalogue, or any other serially numbered matter, by means of the allotted prefix, as explained in the book. To further simplify the reading of a message the small U might be used in the transcript thus—GuHuKuM, GuHuKuR, LuFuLuM, LuFuMuG, &c.

F

Regarding Claim No. 5, the code words transmitted need not necessarily end with a consonant. In fact, the terminating letter U will always show that the words have been linked up and re-divided for the purpose of economical transmission. In the following example five words have been linked up, re-divided, and transmitted as four, showing a saving of 20 per cent. :—BULUGUM, SUTUMUG, DULUFUB, JUBUNUL, KUGUTUM,

BULUGUMUSU/TUMUGUDULU/FUBUJUBUNU/LUKUGUTUM.

Regarding Claim No. 6, the number of changes available is the enormous one of 2,432,902,008,176,640,000, from which it will be seen that a change may be made every day (with the concurrence of the correspondent) without fear of exhausting the possibilities of the system. Sections A, D and E are placed in the book for the use of those who wish to apply them to their own special cases, but Section C comprises all that is necessary for present requirements.

You mention that "We do not quite follow Mr. Rose in this claim" (to check irregularity or mutilation resulting from bad spacing by means of the deletion of the connecting vowel u). This I claim to do invariably within one minute of receiving the mutilated word. But I do not claim to replace a signal omitted entirely. No system can or does. The user, however, has a much better opportunity than ever before of replacing the lost signal, as our word contains only four unknown characters. The position of the error is definitely located, whereas, with an ordinary code word there is the danger of making a wrong replacement and producing an almost identical code word, yet one having an entirely different meaning, the results of which have, on many occasions, been disastrous.

A simple check system has now been devised, and will be issued to all users of the book, by means of which any omission either in indicating consonants or connecting vowels will at once be revealed.

You contend that, owing to the improvement in telegraphic working, the proportion of delays or serious consequences caused by errors is exceedingly small in comparison with the large number of messages handled. This I fully admit, and do not seek in any way to minimise the credit due to the cable companies and the compilers of codes for the magnificent results achieved. There still remains, however, an element of uncertainty, which it is my object to finally eliminate by enabling the user to compile his message on a purely mathematical basis. Errors of a magnitude with which other check systems would find it quite impossible to deal, are immediately located and corrected with absolute certainty. I claim that my system greatly enhances the value and adaptability of existing codes, and indefinitely extends their range of usefulness. It has received the cordial endorsement of eminent code compilers and cable representatives. But, like all new ideas, it has, in the first instance, to overcome the weight of public inertia, and to satisfy the experts, which I have every confidence of being able to do.

Sydney A. M. Rose, A.M.I.E.E.

London, W.C., *November 2nd*, 1909.

NEW ELECTRICAL DEVICES, FITTINGS, AND PLANT.

Electric Lamp Lock.

An extremely simple device for locking incandescent lamps in their holders has been introduced by the ELECTRIC LAMP LOCK CO., of 25, Wellington Street, Glasgow, under the name of the "Ellco" invisible lamp lock, for which a patent has been applied for. It

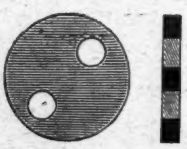


FIG. 1.—"ELLCO" LAMP LOCK.

consists of nothing more than a perforated washer of insulating material (fig. 1), which is dropped over the plungers in the holder. It is necessary to slacken back the ring at the top of the holder before inserting the lamp; after this, when the ring is tightened again, it is impossible to remove the lamp unless the trick is known, for the locking device is invisible from the outside. The high price of metallic-filament lamps renders some such device necessary where lamps are accessible to the public.

The "Best" Electric Radiators.

With this happy and positively convincing title, MESSRS. BEST AND LLOYD, LTD., of Cambray Works, Handsworth, Birmingham, have issued a new catalogue (No. 77), in which they bring before

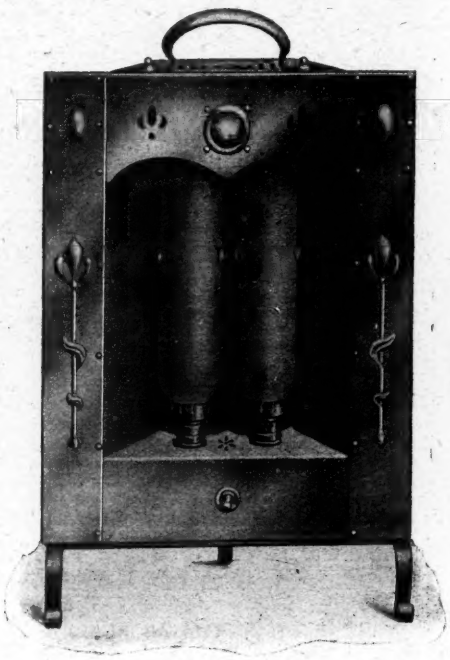


FIG. 2.—"BEST" TWO-LAMP RADIATOR.

the trade some fine designs of luminous radiators for the current season.

There is something impressive about a number of the designs shown. To break forth into song regarding some of the firm's choice art metal-work in electric light fittings is not a difficult

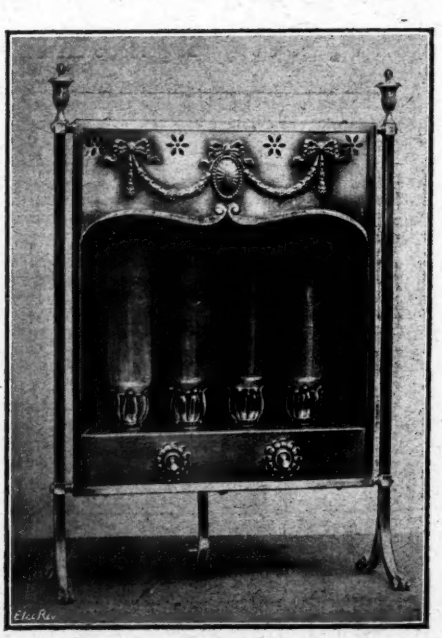


FIG. 3.—FOUR-LAMP RADIATOR, ADAM STYLE.

matter, but we have not often felt moved to rhapsody by the lines and curves of the metal-work enclosing the luminous bulbs of an electric radiator. However, in the list now before us the designs are very acceptable and more pleasing than many that we have seen; good blocks and careful printing have doubtless had much to do with the good effect. The registered designs are all shown to a scale of one-sixth, and they include two, three, four and six-lamp radiators, which are supplied with either wrought-iron or polished

or oxydised brass frames, with polished copper interiors; also with polished copper or hammered antique copper frames, in "Sheraton" style with brass frame, Adam, Empire, Louis XVI, and circular types. In the two examples which are selected for illustration purposes, fig. 2 shows a two-lamp registered design, with hammered antique copper frame and polished copper interior; fig. 3 is a four-lamp design in Adam style, supplied with brass frame, and polished copper interior with ornamental covers for lampholders.

The Venner Patent Sign.

An ingenious device has been put on the market by Messrs. Venner & Co., of 6, Old Queen Street, Westminster. It consists of letters composed of small clear glass balls, which are illuminated from behind, and it possesses the special advantage that owing to the peculiar optical properties of the balls, the letter can be read from almost any position over a range of 160°. The effect, when the sign is illuminated, is that of a continuous letter of light, the individual balls being merged into one another by irradiation. The letter is strong and of inexpensive construction. The

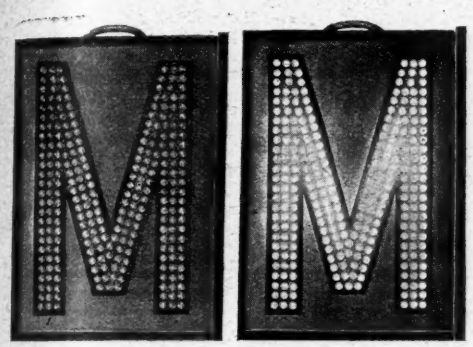


Fig. 4.—Venner Sign, by Day and by Night.

accompanying figures show a single letter, as it appears when unlit, and when illuminated by a single 16 c.p. lamp. When mounted in a suitable frame, a series of these letters can be employed, and they are readily interchangeable, so that a new legend can be displayed each day—a practice which has been adopted by some theatres and electrical showrooms which have adopted the device. Metallic-filament lamps can be used with this sign, and the frame is weather-proof. The extinction of one of the lamps in a frame only causes a slight diminution in the illumination, and does not leave a gap. Chromatic effects are easily arranged, with the aid of coloured lamps, which give a variety of graduated shades of colour. Uniform illumination of a 2-ft. letter with two 32-c.p. lamps is one of the advantages claimed for the system, and the sign at the middle of a street can be read from either end or any part of the street.

Howard-Cousins Patent Radiator.

The popularity of glow-lamp radiators has not owed anything to the construction of the lamps usually employed, which, being modelled on the pattern of the lamps used for lighting, have long looped filaments and are held in holders of the ordinary type. In the Howard-Cousins radiator, made by the General Electric Co., Ltd., of 71, Queen Victoria Street, E.C., the lamps are made double-ended, with zig-zag filaments, so that short circuiting inside the

Fig. 5.—Howard-Cousins Radiator.

lamp is impossible; the massive end contact caps are held in strong spring clips, which provide secure support, and the lamps can be placed horizontally, as shown in the accompanying figure, or vertically, as preferred. The elastic construction of the filament renders it immune from breakage due to shocks, and thus prolongs its life. The figure shows a radiator with the usual wire guard removed, to enable the lamps to be seen clearly.

The Antiforge Pen.

A new patent electric pen, the invention of Dr. Dinshah P. Ghadiali—the "Parsee Edison"—has been introduced by the Antiforge Pen Co., of 448, High Road, Chiswick. The essential feature of this device is that it writes by perforating the paper with electric sparks. The principle, of course, may not be new, but the methods adopted by Dr. Dinshah for carrying it out are certainly novel and ingenious. The pen, as illustrated herewith, resembles

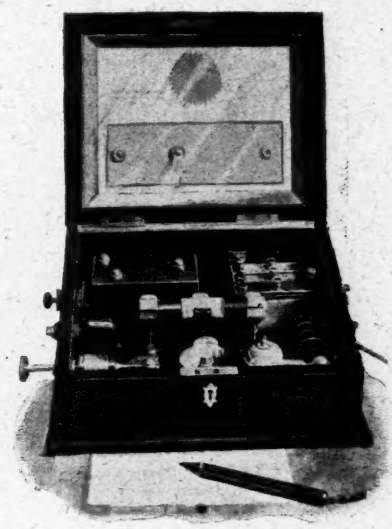


Fig. 6.—Antiforge Pen, and Desk, Open.

a stylographic pen, and is used in conjunction with a polished aluminium plate, on which the paper is laid. The plate is mounted on the bevelled glass top of a desk, which contains the whole of the accessory apparatus, as shown (fig. 6).

The spark is produced by an induction coil excited by a small battery of storage cells, such as is used for ignition purposes on automobiles. To increase the intensity of the spark a condenser is connected across the secondary terminals, and a highly exhausted vacuum-tube is also connected to these terminals, in parallel with the pen, to indicate (by glowing) the condition of the apparatus, besides acting as a ballast load on the coil, and providing a fixed limit to the maximum potential difference between the secondary

Fig. 7.—Antiforge Pen and Desk.

terminals. The pen itself contains a mercury interrupter, which ensures that the primary circuit shall never be closed except when the pen is held point downwards. There is also a spring point actuating contacts within the pen, so that even when the pen is held in the proper position the primary circuit is not closed unless the pen is pressed on the paper in the act of writing. By these means the work of the battery, and the possibility of the operator's receiving a shock, are reduced to the minimum.

The effect of the condenser across the secondary is to give fat sparks, which not merely perforate but actually burn the paper, rendering the record absolutely indelible. By varying the resistance in the primary circuit with a rheostat, of which the handle is seen projecting on the left-hand of the desk, the intensity of the spark can be varied over a wide range, giving from the finest to the coarsest perforations. As it is impossible to produce two identical series of perforations, owing to the variations in the thickness of the paper, the pressure used in writing, and the speed of motion of the pen, the owner himself cannot produce an exact

facsimile of his own signature, though each signature as a whole is unmistakeably his own. This property is utilised when signing a batch of related papers, as the signature is written on the top of the series, and all the sheets are perforated simultaneously; it is then impossible, even for the owner, to substitute a new sheet for any of the batch, without detection.

A graphite point is used in the pen to increase the legibility of the writing, though a metallic point can readily be substituted when only the perforations are required. The apparatus is of British manufacture, and should find many uses in business houses. The inventor, Dr. Dinshah, was formerly electrician to H.H. the Maharaj Rana of Dholpur, and afterwards electrical engineer to the Patiala State, and is a noted journalist and lecturer, as well as an inventor.

LEGAL.

The Summonses against the Welsbach Incandescent Co.

Further evidence was given before Mr. Bros at Clerkenwell Police Court on Saturday, in the case in which the Welsbach Incandescent Gas Light Co., Ltd., were charged on summonses issued at the instance of the Wolfram (Tungsten) Metal-Filament Lamps, Ltd, with selling and exposing goods for sale to which a false trade description had been applied. The alleged offence was in respect of electric lamps marked with the words "Welsbach" and "Aur."

Mr. Rufus Isaacs, K.C., M.P., Mr. H. A. Colefax and Mr. Ernest Lunge appeared for the prosecution; Mr. A. H. Bodkin and Mr. Walter were for the defence.

Last week Mr. Rufus Isaacs, in opening the case, said the Welsbach Incandescent Gas Light Co. was formed for the purpose of dealing with the inventions of Baron von Welsbach in regard to gas lighting, but not in regard to electric lighting. Baron von Welsbach's electric light inventions were acquired by a German company, known as the Auer Co., who, by agreement, appointed the General Electric Co. exclusive agents for the sale of the lamp. The defendant company published an advertisement in which there were illustrations of an electric lamp bearing the words "Welsbach" and "Aur," and he contended that this was calculated to lead persons to believe that the lamp was either invented or manufactured by Baron von Welsbach or the Auer Co.

Frederick Hale, of London Road, Bromley, assistant manager of the General Electric Co., Ltd., produced a copy of the *Daily Telegraph*, of September 23rd last, and said it contained an advertisement of the Welsbach electric light, issued apparently by the defendant company. On September 29th he received certain instructions from Mr. J. Y. Fletcher, manager of the electric light department of the General Electric Co., in consequence of which he went to 334-354, Gray's Inn Road, the address of the defendants. He was taken to the showroom there, and he asked to see a lamp as advertised in the daily papers. The young lady in charge showed him samples, and he asked, "Are these Baron von Welsbach's lamps?" She said "Yes." He ordered two and went downstairs to receive them and pay for them. As the lamps were being handed to him, he asked again, "Are these Baron von Welsbach's lamps?" and the salesman in the warehouse at once said "Yes." The lamps were similar to the one now produced.

Mr. Bros examined the lamp produced in Court, and observed that it had "made in Germany," and the words "Welsbach" and "Aur" upon it.

Witness, in continuing his evidence, said that on October 8th he received further instructions from Mr. Fletcher, and he went again to the premises of the defendant company in Gray's Inn Road, and asked for some more lamps similar to the samples he had previously taken away. He asked the attendant in the warehouse if he could assure him they were Baron von Welsbach's lamps, as the party for whom he required them had made a special point of it. The attendant said they were, and witness then said: "Will you kindly put it on the invoice to enable me to show my customer?" The salesman replied, "Certainly," and did so.

Mr. Rufus Isaacs: Are the lamps with this filament made by any particular firm or company?—Witness: Yes. The chief makers are the Auer Co., of Berlin. He added that he believed "Auer" was one of Baron von Welsbach's names.

In cross-examination by Mr. Walter, Witness said that when he went to the defendants' premises, he gave his name as Holloway, of Bath Road, Hounslow, and produced a trade card.

Mr. Walter: Where did you get that from?—Witness: From Mr. Fletcher.

Do you know where he got it?—I don't know.

Do you know if there is such a person as Mr. Holloway?—I don't know.

Did the young lady in the showroom ask you to go to the trade counter?—Yes.

And at the trade counter did you say you were a member of the trade?—No; I simply asked for the lamps I had ordered in the showroom.

I put it to you, you never mentioned the name of Baron von Welsbach?—I did.

Then if the salesman you saw says you did not, it is not true?—It is not.

What were your instructions from Mr. Fletcher?—To purchase the lamps, and ask if they were Baron von Welsbach's.

Were your instructions on October 8th to get something in writing?—Yes; I was to ask them if they would give it.

Did you ask them if they objected to the words "Baron von Welsbach" appearing on the sale note, as your customer would not have the lamps unless that appeared on the receipt?—I did not.

Do you know if Baron von Welsbach makes any electric lamps?—I do not know.

Does he, to your knowledge, deal in lamps?—No; not to my knowledge.

Tell us how these words got on the receipt?—I said, "Are these Baron von Welsbach's lamps? My customer makes a special point of it." The attendant answered "Yes," and I said, "Will you please put it on the invoice?"

The only metal-filament lamps you sell are the Osrams?—Yes; at the present time.

The Osrams are not the invention of Baron von Welsbach?—They are made under his process, I believe.

Do you know?—No, I do not.

How long ago is it since the only metal-filament lamps you have sold have been Osrams?—Two and a half years.

Where have you seen anything about the Auer Co. in London?—I have seen their correspondence.

Are you aware that they are under contract not to use the words "Aur" or "Welsbach" in the United Kingdom?—No.

The only mention you have seen of the Auer Co. is in private correspondence with your firm?—Yes.

Are you aware that the trade mark "Aur" is put on all the goods sold by the Welsbach Incandescent Light Co.?—No.

Do you know "Aur" is their registered trade mark in this country?—I do not know.

The hearing of the case was further adjourned for a week.

Electricity in Fife Mines.

Mr. H. Rowan, district manager and agent of the Fife Coal Co. at Cowdenbeath, and as the superior to the certificated manager at the Foulford Pit, was charged in Dunfermline Sheriff Court with having contravened the special electrical rules by having inadequate electrical apparatus in the Foulford Pit. Recently the son of the managing director of the company and the certificated manager were similarly charged, and objections to the relevancy of the complaints were repelled. Mr. Rowan denied the charge, and the evidence in the three cases was fixed to be taken on the same date.

Electricity Supply Co. for Spain, Ltd.

In the Chancery Division on Tuesday last, Mr. Justice Parker heard a petition by this company for a reduction of its capital.

Mr. Mark Romer, K.C. (with him Mr. A. G. Wright in support), stated that the company was formed in 1889 for the purpose of manufacturing and supplying electricity in Madrid and other towns in Spain. The original capital was £100,000 divided into 19,900 ordinary and 100 deferred or founders' shares of £5 each. In 1901 the capital was reduced, the shares being written down from £5 to 5s., but at the same time that it was reduced it was also increased by the issue of 40,000 preference shares of £5 each. On January 20th, 1901, therefore, the capital of the company was £205,000 divided into 19,900 ordinary shares of 5s. each, 100 founders' shares of 5s. each, and 40,000 preference shares of £5 each, the preference shares ranking for preference both as to dividend and capital. It was now proposed to reduce the issued capital by £86,650, and that was to be effected by reducing the value of the 34,660 preference shares that had been issued out of the authorised issue of 40,000. The whole of the loss would, therefore, fall upon the preference shareholders, but the whole of the preference shares were held by a Spanish company, who also held a large number of the ordinary shares, and 90 of the founders' shares, and the whole of the shareholders in the Spanish company appeared before the Court and supported the petition. The proposal was to meet loss of capital amounting to £86,650 by reducing the issued preference shares from £5 to £3 10s., and it was shown by the evidence that the actual depreciation in the value of the company's assets was more than that sum. There was a preference in Madrid for a direct-current system over the alternating-current system, which was the one used by the company, and their distributing plant was thus reduced in value. The value of the company's land remained about the same, but the company's buildings had deteriorated from £10,300 to some £5,300; the boilers and engines were antiquated, and practically of no value; the electric plant had also very much deteriorated, and there was a very heavy falling off in the value of the wiring of the system. It appeared that for some years past the directors had been devoting the profits in writing off these depreciations, but they could not keep them down to the real value of the assets, and there was nothing to do but to reduce the capital. There were only nine shareholders, and they had all signed the balance-sheet and appeared to consent to the proposed reduction.

There was no opposition, and his Lordship sanctioned the reduction in accordance with the proposed minutes, and dispensed with the use of the words "and reduced" as part of the company's title.

Engineering Exhibition in Manchester. — Our monthly contemporary, the *Engineering Review*, is promoting an Engineering and Machinery Exhibition, to be held in Manchester from October 14th to November 5th, 1910. The head office is at 16, John Dalton Street, Manchester.

BUSINESS NOTES.

Catalogues Wanted.—As will be seen from an advertisement in this issue, the representative of an Australian house, who will be in London until the end of this month, will be glad to receive copies of catalogues of all classes of electrical manufactures.

British Trade with Russia.—In our recent references to the Russian market, a good deal of advice was given concerning the best methods to adopt in strengthening the British position there. Some very interesting remarks on this subject appear in the 1908 report of Mr. Consul A. W. Woodhouse (St. Petersburg), as abstracted in a Birmingham newspaper. He says that British goods, in spite of the keen competition, rank first in quality. Even the illiterate peasant, whose only tool is an axe—which he uses with marvellous skill—will say with pride that it is "Anglisky," or British, and has served him well for years. So it is with superior and more complicated wares, especially machinery. But the consumer must be constantly reminded of the fact or he will forget it. To gain a thorough knowledge of the requirements of the Russian market, it must be studied on the spot. First and foremost, the business methods of dealers necessarily conform to the economic conditions of their localities, and as ready money is scarce in Russia, they are obliged to give and take credit. Very little business, if any, is done on spot cash terms. Our foreign competitors realised this years ago, and acted accordingly, and that is precisely where they gained they advantage. They will readily supply goods on credit for periods up to a year, and will even then renew bills on easy terms. On the other hand, British manufacturers are only now beginning to realise the necessity of conforming to this custom. Many undoubtedly no longer insist on selling their wares "free on board" at some British port and for cash against bills of lading. This method, so tenaciously observed, in spite of everything, gave foreigners, and especially Russia's nearest neighbours, the opportunity which they promptly seized. They have established branches in the chief cities and appointed agents all over the country. Their commercial travellers visit the markets regularly, taking with them samples and sufficient data to quote prices for delivery direct to the retail dealer or the consumer. It follows that British manufacturers and merchants must do likewise. They can even at this hour profit by the experience of others, before it is too late, and send out commercial travellers possessing a knowledge of the vernacular. Ignorance of the Russian language will only drive buyers to middlemen who can understand them.

Siemens's New Central Depôt.—On November 1st, new premises were opened by Messrs. Siemens Bros. Dynamo Works, Ltd., at 39, Upper Thames Street, E.C, as London stores and showroom. Here, henceforth, all the business of the Supplies department will be conducted, including that hitherto carried on both at 6, Bath Street, E.C., and at 1, Abchurch Yard, E.C. We recently had the privilege of making a run through the building. The new premises comprise six spacious floors and basement. The ground floor is arranged for counter trade, and every facility is provided for promptly executing customers' orders. The first floor is devoted to an extensive showroom, where the Siemens companies' specialities will be exhibited. One feature will be a tasteful display of the latest designs in artistic electric light fittings and shades, exhibited in conjunction with the well-known tantalum lamps. The showroom is specially prepared for effective display; it is wired, like the whole of the other departments in the building, on the Stannos system, and circular selective switches control a number of lights. The third floor is occupied by the manufactures of Messrs. Siemens Bros. & Co., Ltd., and a stock of all sizes of wires and cables is carried. The remaining floors contain a comprehensive stock of all articles required by the trade, including tantalum and carbon incandescent lamps, electric light fittings and shades, conduits and conduit fittings, arc lamps and arc lamp carbons, ampere-hour and watt-hour meters, small generators and motors, electric accessories of all kinds, such as lampholders, switches, fuses, ceiling roses, &c. A Waygood 1-ton lift with a new type Siemens lift motor serves all floors, and there is a small lift beside for parcels. As our readers are aware, the Siemens manufactures produced at their several extensive factories in this country cover a very wide range indeed, it is said that their manufacturing ability covers practically everything from a small incandescent lamp to motors of 16,000 H.P., and from the smallest bell wire to an Atlantic cable. We are sure that this large depôt in so central a position will be a convenience to the electrical trade.

Bankruptcy Proceedings.—Eric Eaton, electrical engineer, 36, Alexandra Road, late 12, George Street, and 2, Streets Yard, Mossley Road, Ashton-under-Lyne, Lancs. The first meeting of the creditors in this case was held last week at the Official Receiver's office, Byrom Street, Manchester, but a sufficient number of creditors to form a quorum did not attend. It was stated that the liabilities amounted to £130, and the deficiency was put at £117. Debtor ascribed his failure to bad trade, lack of capital and loss on contracts.

Philip Ernest Butler, promoter of the Electric Lamp Renovating Co., Ltd., and described under a creditor's petition as late of Hill Street, Knightsbridge. This public examination was held on Wednesday last week before Mr. Registrar Giffard, at the London Bankruptcy Court. The statement of affairs showed liabilities £1,666, and assets £1. In the course of his examination, which was conducted by Mr. W. P. Bowyer, Assistant Official Receiver, the debtor stated that his father died in 1898, leaving him securities to the value of about £20,000. He had since been interested in a number of public companies, of most of which he was a director, and in connection therewith he had sustained considerable losses. In May, 1903, witness promoted the Electric Lamp Renovating Co., Ltd., to which he sold his interest in certain electric lamp patents, &c., previously acquired by him, some from the inventor, and some from the liquidator of a company in which he was a shareholder. The consideration of the sale, which was not completed until the end of 1904, was ultimately fixed at £13,000 in shares and an undertaking by the company to discharge liabilities amounting to about £491. One third of the shares were allotted to the inventor. The sale consideration covered expenses incurred by witness in equipping a factory, taken in his name, at Britannia Street, City Road, E. Witness attributed his failure and insolvency to losses estimated at £30,970 in connection with the above undertakings, and further losses to the amount of about £3,000 by Stock Exchange speculations. In most of the companies he purchased large blocks of shares partly for investment purposes and partly as speculations with the idea of selling out at higher prices. None of the eight companies in which he had been interested were old-established concerns. The examination was concluded.

Russian Platinum.—The fact is recalled that the platinum mineowners, particularly in the Ural, some time ago sought to induce the Russian Government to nationalise the industry, especially the mines in the Nishny-Tagil which produce about three-fourths of the total output in Russia. But the Government declined to embark upon the transaction, although a French syndicate had expressed its readiness to participate in a company for the working of the mines in question. It is now stated that such a company has either been constituted or is about to be formed by all the platinum producers in the Ural, in conjunction with the French firm of Bonardelle, which has hitherto purchased a large portion of the outturn in the Ural, and that the company will take over the Nishny-Tagil mines. In the circumstances it is expected that a slight upward movement in the price of the metal will take place. The French firm will subscribe for shares in the new undertaking to the extent of £600,000. The English firm of Matthey, which was formerly a large customer for platinum in consequence of long-term contracts with producers in the Ural, and which paid a comparatively low price, is reported to have been settled with by the payment of compensation by way of damages.

Catalogues and Lists.—Messrs. J. H. Holmes and Co., Portland Road, Newcastle-on-Tyne.—Several new pamphlets have just been issued relating to different departments of the firm's manufactures. One is a 28-page price list of electrical switchgear, including Holmes-Page switches, replaceable bridge fuses, oil switches, circuit-breakers, fuses in cast-iron boxes, solenoid main and starting switches; the second is a 36-page catalogue of the "Castle" motors and dynamos, motor-starting rheostats, &c., containing a large quantity of tabular matter, dimensional information, and directions for coupling up motors to mains. The third is a 24-page pamphlet containing a list in tabular form of electric lighting and power installations put down by the firm for mining work, electrically-driven plant being shown. All three lists are laid out in good style, and a large number of well-executed and boldly-printed half-tone illustrations appear in each.

The Lahmeyer Electrical Co., Ltd., 109-111, New Oxford Street, London, W.C.—Eight-page list describing and illustrating their automatic high-tension oil switches, which are specially suitable for working under severe conditions, such as are met with in fiery mines, atmospheres containing acids, and dangerous gases, &c., where open type switches are inapplicable. A second list in similar form and size gives a full description of the Lahmeyer turbo-alternators, the illustrations showing parts of 5,000-KW. and 3,000-KW. machines, and views of Continental stations with Lahmeyer turbine sets in position. The turbine list describes the firm's generators, both for alternating and continuous current. The Lahmeyer Co. are agents in this country for the "Zoelly" steam turbine as manufactured at Messrs. Escher, Wyss & Co.'s Works, Zurich, and are therefore well able to quote for combined plant.

Mr. G. Wuthrich, Oswaldestre House, Norfolk Street, Strand, W.C.—Leaflet giving illustrations of a number of their electrical machinery and apparatus manufactures; also an eight-page pamphlet containing a reprinted article on Oerlikon new five and six-speed three-phase motor.

The Valor Co., Ltd., Rocky Lane, Aston Cross, Birmingham.—A number of leaflets relating to the "Valor" automatic waste oil filter, fire extinguishers, &c.

The Regent Electric Co., Ltd., 52, Regent Street, Piccadilly Circus, London.—Leaflets relating to the "Holmquist" electric heat pads and hat pads which have attracted a good deal of attention from visitors to the recent electrical exhibitions; also the "Holmquist" electric light bath cabinets.

Messrs. A. E. Harris & Co., 95, Camden Street, Birmingham.—Four-page illustrated list of copper switch clips of standard sizes, fuse board clips, copper contacts, name plates, and stampings for the trade.

Messrs. Alley & Maclellan, Ltd., Sentinel Works, Polmadie, Glasgow.—Eight-page illustrated pamphlet giving descriptive information concerning their "Sentinel" double-acting forced lubrication high-speed engines, with tabulated sizes, outputs at various steam pressures, condensing and non-condensing, and prices, of two-crank compound, and three-crank triple-expansion engines. Weights and shipping particulars also appear. The illustrations show engines direct coupled to electric generators, but they can also be arranged with belt or rope pulley for factory and mill driving.

Messrs. Veritys, Ltd., 28, King Street, Covent Garden, London, W.C.—Postal card effectively drawing attention to their "Comet" arc lamp.

The Adnil Electric Co., Ltd., Adnil Building, Artillery Lane, London, E.C.—Price leaflet of their direct-current motors of from ¼ to 5-h.p.

The Liverpool Electric Cable Co., Ltd., Vauxhall Road, Liverpool.—Reprint copy of their latest catalogue (50 pages) of "Liverpool" electric wires and cables. The first few pages contain tabular information regarding standard sizes of conductors, and extracts from the I.E.E. wiring rules; particulars are next given of first quality and non-Association quality respectively, and the other sections that follow relate to silk and cotton-covered wires for dynamos and instruments, lead-covered and armoured cables for mining purposes, flexible conductors, electrolier wire, shot-firing cables, motor-car flexibles, resistance wires, dynamo flexible cables, jointing materials, clincher cable clips, &c. Various additions and alterations have been made in the tables since the last catalogue appeared.

The Chloride Electrical Storage Co., Ltd., Clifton Junction, Manchester.—Circular No. 25 (20 pages) giving very fully detailed information regarding the "Entz" booster, with curves, diagrams, and half tones, and with descriptions of installations of their boosters and Chloride batteries in industrial works. One of these installations is at the Dalzell Steel and Iron Works of Messrs. David Colville & Sons, Ltd.; others are at Halifax and Maidstone electricity works. A specification follows for standard "Entz" booster and switchboard for traction system, 400 amperes, 90 volts continuous output.

Schiebsteiner Metallwerk, Schwerinstr. 3, Berlin W. 57.—Leaflets describing their cyclometer length measuring instruments for roads and railways, and for wires and cables.

The Dowsing Radiant Heat Co., Ltd., 24, Budge Row, Cannon Street, London, E.C.—A 54-page catalogue is devoted to the description and illustration of many designs of electric radiators for the current season. "Notes on using the luminous radiators" preface the pages illustrating the different designs. The latter include new specimens in various periods and styles, such as Jacobean, Georgian, Tudor, Elizabethan, Sheraton, Adams, &c., with framework in ornamental wrought-iron, polished copper, antique hammered copper, block enamelled cast-iron, antique dull brass finish, ornamental brass with copper pillars, green Doulton ware, and other metals and finishes, all fitted with patent coppered interior and reflector. The Dowsing-Huntley patent combined radio-converter is a feature of the book. It is fitted with four luminous heat lamps, also with non-luminous elements, the total consumption being 2,000 watts. These radiators are specially recommended as efficient and rapid heating appliances. Some cheap designs in convectors or air heaters pure and simple, with non-luminous heating elements are included in the list. Mr. Dowsing has made radiators of this type for the past twenty years, but they have not been included in the firm's list of luminous radiators until now. Prices of all designs are boldly indicated.

Tramway Points.—It is reported from Brussels that the Brussels Tramway Co., the Chemins de Fer Economiques, the Société de Transports et d'Enterprises Electriques, the Société Générale d'Enterprises Electriques and the banks associated with them, are forming a company with a share capital of £10,000 for the introduction of the invention devised by the Italian Captain Dino Samaia for the automatic working of tramway points. The apparatus is operated from the driver's platform, and trials made in Brussels are said to have been carried out to the satisfaction of the experts who were present.

Book Notices.—*Magnetos for Automobilists—How Made and How Used.* By S. R. Bottone. Second edition, enlarged. London: Crosby Lockwood and Son. Price 2s. net.—We have a feeling of sadness in turning over the pages of this useful little work, as it is, perhaps, the last that will bear the author's name, for his death took place shortly after he had passed its pages for the Press. In view of the fact that during the past two years or so, magneto ignition has become the standard method of firing the explosive charge in the engines of petrol motor cars, the book is one that cannot fail to be both interesting and instructive to those motorists who take a practical interest in the details of their vehicles. To many the magneto and its method of generating an electrical current are still a mystery; a perusal of the simple explanation furnished by Mr. Bottone should, however, do much to render the principles on which this system of ignition is built up readily comprehensible by the merest novice. The subject is dealt with in a series of seven chapters, in the first of which the history and theory of the magneto is traced. Then follows an explanation, in simple language, of the component parts of a magneto machine, the functions of the same being described, and elucidated by means of a number of line drawings; other chapters deal with magnetisation and the armature screen. Although the late Mr. Bottone, judging from his remarks, was distinctly in favour of the low-tension form of magneto for ignition purposes, he did not overlook or disregard the high-tension machine, the method of generating a high-tension current being dealt with in a separate section, in which the Simms-Bosch, the Eisemann, and Gianoli—three of the types largely used—are fully described. Finally, we have "A Few Practical Hints" and "Latest Types of Magnetos," the last chapter—the *raison d'être* of the second edition—giving particulars of a number of new magnetos that have been put on the market since this form of ignition became the accepted type. The late Mr. Bottone was a prolific writer of popular handbooks, and in his "Magnetos for Automobilists" produced one which is not only well worthy of perusal by all owners and drivers of motor-cars, but one that may usefully find a place on the "Reference Book" shelf of their libraries.

Annuaire pour l'An 1910. Paris: Gauthier-Villars. Price 1 fr. 50 c.—The year-book of the Bureau of Longitudes—the 115th of its kind—contains this year tables and data relating to physics and chemistry, which alternate with the geographical and statistical matter. Coming from so distinguished a source, the contents may be accepted as accurate and reliable, and an alphabetical index of unusual completeness, for a Continental work, renders them readily accessible.

The "Mechanical World" Pocket Diary and Year-Book for 1910. Manchester: Emmott & Co. Price 6d. net.—This pocket-book, now in its twenty-third year, contains a new section on oil engines, by Mr. W. A. Tookey, who has also revised the section on gas engines. Mr. B. M. Woodhouse has contributed some notes on centrifugal pumps, and a section on ball bearings has been added. The book is now printed on a thin tough paper of better quality, reducing its bulk without altering the number of pages.

"Report on the Tungsten Ores of Canada." By T. L. Walker. Ottawa: Department of Mines. 1909.

"The *Mechanical World* Electrical Pocket Book for 1910. Manchester: Emmott & Co. Price 6d. net.

"The Physical Review." Vol. XXIX, No. 4. October, 1909. New York: The Macmillan Co.

"Atti della Associazione Elettrotecnica Italiana." Vol. XIII, part 4. Milan: The Association. Price L5. The Central Office of the Association has been removed to Via S. Paolo N. 10, Milan.

"Electric Cables: Their Construction and Cost." By D. Coyle and F. J. O. Howe. London: E. and F. N. Spon. 1909. Price 15s. net.

"Gas Works Directory and Statistics, 1909-10." London: Hazell, Watson & Viney. Price 10s. 6d. net.

In making its bow to the public the *Local Government Review* announces that it will "devote itself" exclusively to the adequate and impartial treatment of the great range of subjects classed under the term "local government." The contributions in the first issue (November, monthly 1s. London: Simpkin Marshall, Hamilton, Kent & Co., Ltd.) include articles on afforestation, poor law, city bridges, German municipal government, coast erosion, the rating of owners, municipal finance, and other subjects.

Trade Announcements.—We understand that, owing to the success of their meters and motor-control gear, and the rapidly-increasing demand for them, The Electrical Apparatus Co., Ltd., of Queen's Road, Battersea, are making considerable extensions to their works. These will be completed by December 1st. The demand for both meters and motor-control gear is said to be three or four times as big as it was eight months ago. The company are just placing on the market a new motor and prepayment meter.

Mr. A. Feld and Mr. F. W. Sichtermann have resigned their positions as managers in the Electrical Co., Ltd. (A.E.G., Berlin), and have established themselves as suppliers of all electrical materials for lighting and power plants. The style of the firm is Feld Bros. & Co., Ltd., 25, Budge Row, E.C. (Telephone No. 1,697, London Wall). They are putting on the market a new metallic-filament lamp, of entirely British make, under the name of "Field." Price-lists will be issued shortly.

The Armorduct Manufacturing Co., Ltd, have issued a circular announcing further advances in the prices of vulcanised rubber insulated wires and cables and pure rubber insulated conductors owing to the continued high price of rubber.

Dissolutions and Liquidations.—Solium Electrical Co., Ltd.—A meeting of creditors in this voluntary liquidation is to be held at the office of the liquidator (Mr. Edward Harlow), 23, King Street, Manchester, on Friday, November 12th, at 12 o'clock noon.

Vaughan & Cook, Ltd.—A meeting to hear an account of the winding up from the liquidator, Mr. L. V. Houseman, is to be held at 33, Bedford Row, W.C., on December 3rd.

Howe Electrical Engineering Co., electrical engineers, Redcross Street and Moor Street, Liverpool and Blackburn.—Messrs. W. Sutton, S. Lord, and J. W. Garsden have dissolved partnership. Messrs. Lord & Garsden will attend to debts and continue the business.

LIGHTING and POWER NOTES.

Australia.—The Sydney Council has agreed to Mr. Forbes Mackay, city electrical engineer, negotiating with the Glebe municipality with a view to laying mains and supplying electricity in the area, Glebe to have the right of purchase in 25 years. The City Council has decided to petition against the North Sydney Electric Lighting Bill.

Bury.—A letter has been received by the Electricity Committee from several local photographers pointing out that arc lamps were used in connection with their businesses, both during the daytime and evenings, and asking that the price charged for electricity might be reduced. The application, after discussion, has been acceded to.

Caerphilly.—The *London Gazette* contains notice of the intention of the U.D.C. to transfer its prov. order to the South Wales Electrical Power Distribution Co. for £10.

Castleford.—The U.D.C. has informed the B. of T. that if the Council could be assured that the Electric Distribution of Yorkshire, Ltd., would be in a position to carry out the E.L. order within the early months of next year, it would hesitate before taking steps to apply for an order on its own behalf. But in view of the long delay in carrying out the provisions of the order, the Council is somewhat dubious as to the promise of early attention, and it had been decided to proceed with the necessary steps to obtain an order. Since then the B. of T. has granted the application of the Electrical Distribution of Yorkshire for an extension of time for carrying out its order.

Cleethorpes.—On October 28th a L.G.B. inquiry was held into the application of the U.D.C. for a loan of £4,000 for laying mains in the busiest part of the town, where 81 residents, including 54 tradesmen, have signified their intention of becoming consumers. It was stated that in 1912 the Council would exercise its right to take over the power station erected by the Grimsby Street Tramway Co. for £17,000, less depreciation. It was also intimated that new property being erected was being wired in anticipation of the scheme going through. There was no opposition.

Continental Notes.—AUSTRO-GERMAN WATER-POWER DISPUTE.—A new difficulty has arisen in recent months in connection with the proposals for the utilisation of water-powers in Bavaria for State and private purposes, in consequence of differences of opinion between Bavaria and Austria in regard to sovereign rights and obligations in respect of the adjoining territory. Austria claims the right of artificially diverting waters rising in Austria and flowing over into Bavaria, but the latter country disputes the possession of the right. If the dispute were a theoretical one the solution could be left for the distant future to solve. But Austria seems to make the supply district of the Chiemsee a serious matter, and to desire to withdraw about one-third of the water-power of the Alz. So long as this danger threatens, it is considered that no industrial undertaking will be willing to assume a concession for the use of water-power in the country. The Badische Anilin und Sodafabrik has for years been seeking a concession for the erection of nitrogen works by the use of a portion of the fall of the Alz, which is the second largest water-power in Germany. The Government made inquiries of manufacturers as to their prospective demands for power, but these were unsatisfactory, and it then seemed as if the Baden company's application would be granted. In the meantime the dispute has arisen with Austria, and although the subject was discussed several months ago in Vienna between representatives of both Governments, no progress was made towards a settlement. It is believed that Prussia is also interested in the question, although to a less extent than Bavaria, and the hope is expressed in the latter country that Austria will consent to have the problem referred to the Hague Court of Arbitration for decision.

BELGIUM.—A large electricity generating station has just been completed and put in operation at the works of the Societe Metallurgique du Hainaut, at Charleroi. The plant includes two 1,250-H.P. gas engines.

Dundee.—Mr. Richardson, the Corporation electrical engineer, reported to a meeting of the Public Health Committee that there was reason to believe the material used for the electric lighting of King's Cross Hospital was not up to specification. Mr. Richardson was instructed to enforce the carrying out of the terms of the contract.

Eccles.—The T.C. has fixed the following scale of charges for meters:—2½-ampere, 1s. 6d. per quarter; 5-ampere, 1s. 6d.; 10-ampere, 1s. 6d.; 20-ampere, 2s.; 40-ampere, 2s. 6d.; 80-ampere, 4s.; 120-ampere, 4s. 6d.; 200-ampere, 5s.

Hull.—Messrs. Wray & Sanderson have applied to the T.C. for a supply of electricity in bulk to their works in Morley Street.

The E.L. Committee has voted £50 for the purchase of small apparatus for heating and cooking by electricity, with a view to popularising the use of the supply for these purposes.

India.—The Punjab Chamber of Commerce has decided to address the Punjab Government with a view to obtaining certain amendments in the Indian Electricity Act of 1903, which would have the effect of facilitating the supply of energy by overhead transmission wires, especially where it is necessary to pass over private property.

Japan.—It is announced that the Tokio Electric Light Co. has decided to increase the capacity of its hydro-electric plant from 35,000 H.P. to 50,000 H.P.

Kingston-on-Thames.—At the last meeting of the Council the 15th annual report of the borough electrical engineer, Mr. J. E. Edgcome, was presented, and showed a deficit balance of £1,251 on the year's working. The receipts fell from £11,190 to £10,987, while the expenditure had risen from £12,074 to £12,239. The decrease in income was ascribed to metallic-filament lamps, and the reduction in the price of current for motor and heating purposes, while the increase in the expenditure was put down to the fact that, by direction of the L.G.B., the payment of employés was charged to revenue account, whether the staff were employed on works of a capital or a revenue character.

Lees.—The Oldham T.C. has applied to the U.D.C. for for consent to its supplying energy in the district, there being prospective consumers. The U.D.C. has decided to ascertain what consideration Oldham is prepared to pay for the privilege.

London.—HAMMERSMITH.—At a recent Guardians' meeting the question of electricity supply to the Infirmary came up for discussion. One of the Guardians, a Mrs. Graves, thought it would be useful if a committee of women was appointed, as men had been considering the matter for 18 months with practically no result.

STEPNEY.—We are informed by Messrs. Bruce Peebles & Co., that the 2,000-K.V.A. turbo-alternator at the B.C.'s new station at Blyth's Wharf, is a Willans-Bruce Peebles set, and not as stated last week.

Luton.—The adjourned L.G.B. inquiry into the application for a loan of £11,707 for electricity purposes, was held on October 26th. The Inspector (Mr. H. R. Hooper) had reported to the Board with respect to £7,207 for buildings and machinery, leaving for further consideration the item for mains, in order that the suspense accounts might be made up to April 1st of this year. The application was not increased by £3,000 for mains, and, as a result of the suspense account submitted, £646 14s. 5d. was struck out of the proposed loan. The Inspector said he thought they now had a perfectly fair basis to start upon.

Navan.—The scheme for the electrical lighting of the Union, recently formulated by Mr. A. Scott, Dublin, has been submitted to the L.G.B. The U.D.C. is applying to the B. of T. for a provisional order empowering the Council to supply electricity in its jurisdiction for public and private purposes.

Newcastle (Staffs.).—At a recent meeting of the Council a question was raised as to whether Mr. de Rensi was the electrical engineer to the Council or not. It appeared that every member of the Committee thought he was, but no minute confirming the appointment could be unearthed, so eventually the Mayor tried to settle the matter by adding to a report, "Mr. de Rensi is hereby appointed electrical engineer of this borough." This apparently easy way out of the difficulty was, however, disallowed on the vote.

Portsmouth.—At a meeting of the T.C. held on October 26th, the Electric Lighting Committee submitted the report of the consulting engineers on the contract of Messrs. Willans & Robinson, for the supply and erection of a 1,000-KW. alternator and condensing plant, and recommended that the firm be required to raise the efficiency of the plant to meet the requirements of the contract, and that the maintenance guarantee be extended for a period of four months. It was also recommended that four superheaters be installed at a cost of £713.

The Finance Committee has purchased £2,500 worth of Portsmouth Corporation stock at 87½ per cent., as an investment for the Electric Light Committee's reserve fund.

Reigate.—The T.C. has applied to the B. of T. for permission to supply electricity outside the borough. A prospective consumer has agreed to bring his cable up to the terminus of the Council's cables, and thus there will be no capital expenditure on the part of the Council.

Royton.—The U.D.C. has definitely decided to allow Oldham T.C. to supply electricity in the Royton area.

St. Helens.—In order to supply energy to the Sherdley Colliery, the Electricity Committee of the T.C. has decided to extend the overhead feeders from Sherdley Glass Works.

South Africa.—At a Council meeting held at Benoni (Transvaal) on September 30th, it was agreed to accept an offer from the Kleinfontein G.H. Co. to supply current at 2½d. per unit at the switchboard for seven years. A similar offer was made by the Victoria Falls Power Co.

Spalding.—The canvas of the compulsory area for probable consumers of electricity has not proved very satisfactory, and the U.D.C. has decided to ask the B. of T. for a further extension of the order.

Stevenage.—With reference to the transfer of the E.L. order, a syndicate has informed the U.D.C. that it will canvass the district with the object of ascertaining the prospect of providing an installation. If the results are favourable, it will take over the order on a 14 years' lease, under certain conditions.

Wimbledon.—The T.C. has approved of the specification submitted by the B.T.-H. Co. for a horizontal Curtis turbine to be substituted for the vertical turbine recently installed by the firm.

The borough electrical engineer reports that the Howden 1,000-KW. turbo-alternator was completed and in working order on October 7th. The question of enforcing payment of penalties for non-completion within the specified contract time was left over for further consideration.

TRAMWAY and RAILWAY NOTES.

Aberdeen.—The Electricity Committee has considered the remit made by the T.C. in regard to enforcing the arbiter's award between the Corporation and the Suburban Tramway Co. as to price charged for energy. It was agreed, in the first place, to take the necessary step of obtaining the approval of the B. of T. before enforcing the award.

Belfast.—At the quarterly meeting of the Corporation on the 1st inst., various matters in connection with the tramways were discussed, and amongst others it was suggested that a line should be constructed to the top of the Cave Hill, the old world fortress which looms over the city, and which stands over 800 ft. above its level. Extensions of the system on the Donegall Road, Ravenhill Road, Shore Road, Ligoneil line, and Old Park Road, were urged by various members, and it is known that some of these will be attended to in the near future. It is a wonder that no effort has been made to construct a line to the top of the Cave Hill, a place which is constantly patronised by those who can do the stiff walk required to reach it.

Blackpool.—At the meeting of the T.C. on Tuesday, Alderman Brodie (chairman of the Tramways Committee), stated that up to the end of September the takings on the cars were £1,700 ahead of last year, and during the first fortnight in October, there was a falling off of £300. Up to Thursday night there was, however, a wonderful change, for the receipts showed an increase of £4,000 on the corresponding period of last year. There was no doubt the flying week had brought them an extra £2,000. Several months ago the Tramways Committee introduced an innovation by providing for children to travel free on all the cars on Wednesday afternoons, the only stipulation being that they should be accompanied either by their parents or guardians, and Alderman Brodie said they might almost allow everyone to ride free in the winter, as the receipts were comparatively small.

Brazil.—Serious disturbances occurred in Bahia on October 7th and 8th, owing to a car belonging to the Light and Power Co. having knocked down and killed a blind man who was crossing the street. The people in their indignation attacked various tramway stations and upset a number of cars, setting fire to several and throwing parts into the sea. The offices of the company were attacked, and one of the engineers in self-defence shot one of the crowd and injured several persons. The damage to the company's property is estimated at several hundred pounds, but it is believed that the company will ask for indemnification from the Government of the State of Bahia.

Continental Notes.—FRANCE.—The Paris, Lyons and Mediterranean Railway Co. intends, in conjunction with the Elektricitäts-Gesellschaft Alioth, of Basle, to convert the main line section between Cannes and Ventimiglia to electric traction. A short section from Frasse to Mouans-Sartoux will be equipped at once for experimental purposes. This section is specially suitable on account of its having gradients and sharp curves, and the fact that there is not much traffic on this part of the system. An overhead equipment for 12,500 volts single-phase will be installed on a new multiple catenary system. Wooden poles are to be used on the experimental section, but eventually steel girder supports will be adopted. The first locomotive will have four driving axles and a bogie truck at either end. It will be about 65 ft. long, and will weigh 140 tons, the drawbar pull will be some 16,000 lb. at 36 miles per hour, and 10,600 lb. at 62 miles per hour. The alternating current is to be converted to continuous current on the locomotive at any pressure up to 600 volts. Each driving axle will be geared to a 450-H.P. continuous-current motor.

It is stated that the Chemin de Fer du Midi has given out contracts for the conversion to electric working of 400 km. of main line between Bordeaux and Toulouse, a single-phase system at 15 cycles being adopted.

According to the daily papers, on Saturday last an electric train, running at high speed down a hill between Villefranche and Bourg-Madami, in the Pyrenees, left the rails owing to the driver having lost control, and fell into a ravine. Six persons were killed and 12 injured, all being railway employés who were testing the line, which is not yet open for public traffic. Among the killed was Major Gisclard, one of the engineers to the line.

GERMANY.—After remaining in abeyance for several years, the scheme for the construction of an electric railway between Cologne and Dusseldorf, with the privilege of utilising the tramways in each town, has made a certain step forward. The Prussian Minister for Railways has just declared himself prepared to entrust the project to private enterprise and to seek a royal concession for the purpose. As applications for a concession have been made by the two towns and by the large electrical firms, including the A.E.G. and the Bergmann Electricity Works, it will be necessary for these to combine their respective interests before the actual concession is proceeded with by the Minister.

AUSTRIA-HUNGARY.—Permission has been granted to the Abbazianer Elektrisitäts-und-Kleinbahngesellschaft, Vienna, for the extension of the Abbazia-Mattuglie electric railway to Lovrana *via* Volosca and Abbazia.

A scheme for the contruction of a narrow-gauge electric railway between Grein and Gross Gerungs is at present under consideration.

BELGIUM.—A new line of electric tramway in Brussels, between the Bourse and the Place des Gueux, was opened on Saturday last.

Darcy Lever.—The work of constructing tramways between Bolton and Darcy Lever village will shortly be commenced, the necessary surveys having been made.

Dunfermline.—The Dunfermline and District Tramways have now been completed and inspected by the B. of T. The company is to employ about 20 cars.

Liverpool.—The City Council, at the meeting on October 28th, passed a resolution to apply for sanction to the borrowing of £10,000 for the provision of additional cars for the electric tramway service, and, in reply to questions, the Chairman of the Tramways and Electricity Committee (Sir Charles Petrie) stated that the Corporation had been making its own cars for the last seven or eight years. Mr. H. R. Rathbone hoped that they would have an opportunity of discussing the question whether these new cars should be made municipally or by contract. It was an important question which they could not take for granted. They ought to have a report as to what the cars had cost and what they would have cost had they been constructed on contract.

Morecambe.—The T.C. has applied for a loan of £3,465 for the tramway permanent way.

Japan.—According to a local newspaper, a company is to be floated, with a capital of 2,000,000 yen (about £200,000), to construct and work an electric railway to run for a distance of some nine miles in the suburbs of Tokio, and to be connected with the Tokio Railway at Otuska.—*Board of Trade Journal.*

London.—In July last the L.C.C. decided to apply for authority to construct certain new tramways mainly in North London, at a total cost of £856,910. Since that date further proposals have been considered, and it is recommended that 15 miles of additional track in North London, to cost £328,695, should be adopted. This estimate does not include sub-stations, their equipment, and cars, or certain widening expenditure. The Highways Committee further proposes that the Mitcham Lane (Streatham) Garret Lane (Tooting) and Rainton Road to Chapel Street (Woolwich) tramways should be proceeded with, these lines being authorised by Parliament.

Conciliation Boards are to be established for the tramways for the (1) traffic; (2) rolling stock; (3) electrical; and (4) permanent way and building departments. On each of the first two the men will have six representatives, and on each of the others, three.

A regular experimental electric train service was started on October 29th, between London Bridge and Victoria Stations of the Brighton Co.; the service will be continued every week-day between 8 p.m. and 3 a.m. Experimental running has, of course, been in progress for some months during the day.

Pontypridd.—The receipts of the Council tramways have recently dropped considerably, and the manager (Mr. J. E. Teasdel) attributes the decrease in part to the operation of the Mines Eight Hours Act. The hours for the use of workmen's tickets having been extended, the ordinary traffic has been affected, and working expenses have at the same time been increased. The average weekly receipts have dropped by about £7, compared with last year's.

Rawtenstall.—The T.C. has unanimously decided to take steps for securing powers to construct and work an electric tramway in Lumb Valley, from Waterfoot to Dean Lane—2 miles.

Rhondda.—The U.D.C. has decided to apply for Parliamentary powers for the construction of tramways to Mardy, Blaenrhondda, and Williamstown, and to lease the powers to a company.

South Africa.—The Transvaal Government has approved of the electric tramway scheme proposed by the Pretoria Municipality, provided that the system be constructed and conducted in conformity with the B. of T. Rules. The scheme is estimated to cost £160,000, and the Works Committee is authorised to call for tenders for such part of the work as it considers should be done by contract.

Stirling.—At the annual meeting of the Stirling and Bridge of Allan Tramways Co., which clings to the old-fashioned horse, a shareholder asked if there was no possibility of introducing another system of traction. Mr. T. A. Mortimer, of Rhynd, Dunfermline, the chairman, said that on two occasions they had provisionally sold the company for the purpose of having the tramways electrified. He thought the present rails could carry a light motor quite well. Mr. Henderson, the managing director, had been asked to make inquiries. A shareholder said that with a better system of traction they could double their dividends. The matter was left in the hands of the directors.

Sunderland.—The B. of T. has sanctioned the doubling of the track in Ryhope Road, Sunderland, from Villette Street to Spelter Works Road. This will enable an improved service to be run. The work, it is expected, will be commenced after the new year.

United States.—The Westinghouse Co. is stated to have secured the contract for two 25,000-H.P. water turbines coupled to 15,000 KW. generators for installation in the Edward's River power house of the Rock Island Southern Railway.

The Chicago Railways Co., operating over 170 miles of street tramways, has, since the present season commenced, built over 90 miles of track, which is considered a record for this class of work. The company has 650 pay-as-you-enter cars in service; 457 other

cars are being remodelled to this type, and 350 additional cars of this type are on order.

It is reported, says *Electric Traction Weekly*, that a consolidation of Chicago public utility corporations is being planned by a group of Chicago and New York financiers—the total capitalisation representing 300 million dollars. It is proposed to consolidate the street cars, the elevated railroads, the Commonwealth-Edison Co. and subsidiary electric supply interests.

The Illinois Central Railroad directors have passed a resolution deferring electrification of the Chicago suburban service until "such time as a continued study of the subject can intelligently determine the proper line of procedure." Upon learning this decision the Chicago City Council is reported to have drafted an ordinance with the intention of compelling the electrification of all the steam roads in the city within two years, and prescribing a penalty of $100 for each day's delay in submitting plans, over six months from notification. The Railway Co. asserts that the traffic density is not sufficient to enable electrical working to pay; it also points to the lack of interchangeability and trouble caused from it, on the New York Central and New Haven lines at New York, which conditions it is not desired to have at Chicago.

TELEGRAPH and TELEPHONE NOTES.

Australia.—The Commonwealth Government has accepted a motion to the effect that wireless stations should be established round the coasts of Australia. An allowance of £10,000 has been made in the Estimates, for which, it is expected, two stations can be erected, one at Sydney and the other at Fremantle or Rottnest.

Cables Interrupted.—

Sitka-Valdez	October 28th.
Lowestoft-Emden	„ 30th.
Balikpapan-Kwandang	November 1st.

Canada.—On October 18th the Canadian Pacific Railway placed in operation a telephone wire from Cartin, in Ontario, to Brandon, in Manitoba, a distance of 1,045 miles. This is the nucleus of a system which will stretch from the Atlantic to the Pacific, with telephones along the company's branches. For the time being the wire from Cartin to Brandon will be used for emergency purposes only, but it is possible that the company will utilise it for dispatching trains before long. Every station and section house between Cartin and Brandon is a telephone exchange, and, in addition, each train will be fitted with apparatus which will enable the conductor to obtain connection with the nearest town from any point along the line in the event of an accident. The company is also installing a similar wire between Swift Current and Medicine Hat, and it is expected that this section will be linked up with the line now completed before the end of the year.

Long-Distance Telephones.—The Swedish Board of Telegraph Commissioners has obtained permission from the Government to purchase for kr. 25,000 the long-distance telephone invented by Messrs. Egnér & Holmström. It is stated that conversation is possible with this device over a distance of 3,000 to 4,000 km. The Ericsson Co. has secured the patent rights for a new strong-current microphone for long-distance telephony, which, it is said, permits of iron being used more freely than hitherto, instead of copper wires.—*Affärsvärlden.*

The New Argentine Cable.—A Buenos Ayres German correspondent confirms the report already announced by telegraph to the effect that the Western Telegraph Co. has been granted by the Argentine Congress a concession for the establishment of a direct cable between that country and Ascension, and states that the scheme was only a pretext to secure a cable monopoly. The monopoly, which was originally of practically unlimited duration, has been restricted to 25 years by the addition of a fresh clause by the Chamber, and it is also expressly declared that the company's privileges do not apply to wireless telegraphy. If, therefore, the German cable which is about to be laid to North Brazil cannot be extended to Rio de la Plata, the correspondent remarks that the way is still open for the eventual establishment of competition by means of wireless telegraphy.

Postal Telegraphs.—The report of the Postmaster-General, just issued, shows that during the year 1908-9 84,825,000 telegrams were transmitted, a decrease of 1·3 per cent. The total number of telegraph offices is now 13,490. The number of foreign telegrams, inward and outward, was upwards of 9,421,000, an increase of more than 274,000. Twenty-eight licences, covering 48 installations, were granted for experimental wireless stations. The trunk telephone exchanges open numbered 598, an increase of 47; during the year 141 trunk circuits were opened, making a total of 2,526. The capital expenditure on the trunk telephone system was increased by £736,138 to £4,682,796. The total number of conversations over trunk lines was 23,502,024, an increase of 6·86 per cent. The gross revenue from inland calls was £573,883, an increase of 7·25 per cent., and the average receipts per conversation were 5·86d. Continental calls brought in a revenue of £22,125, an increase of £938.

The telegraph revenue of the year was £3,099,724, a decrease of £1,216, and the expenditure, including interest on purchase capital, was £4,218,659, an increase of £44,776. The telephone revenue was £1,522,442, an increase of £139,262, and the expenditure was £1,567,570, an increase of £133,219, leaving a net deficit of £45,128.

There are now 25 commercial, 11 private, and 164 experimental wireless stations in the United Kingdom.

The underground telegraph line between Glasgow and Edinburgh is practically complete; the line running south from Newcastle has reached Stockton-on-Tees; that to the west, Penzance; and the extensions from Birmingham and Bristol have reached Worcester and Berkeley. It is intended to provide underground connections with the landing places of the principal submarine cables to the Continent.

The total number of British merchant ships now equipped with wireless apparatus is over 100, most of them being Atlantic liners. The International Radio-Telegraphic Convention has worked smoothly, and its effect has been distinctly advantageous to the Marconi Co., which has co operated loyally with the Government in carrying out the provisions of the Convention. The number of outward radio-telegrams dealt with during the year was 1817, and inward 22,732.

During the year 102 P.O. telephone exchanges were opened in the provinces, and 55 public call offices connected with the trunk system. Numerous additions have been made to the rural call offices, which are served by adapting existing telegraph wires for local telephone working.

The total number of subscribers to the P.O. provincial telephone exchanges at the end of March, excluding Glasgow and Brighton, was 12,618, as compared with 11,579. The number of subscribers in Glasgow was 8,525, and the number of stations 15,595; at Brighton the numbers were 1,211 and 1,731. At Glasgow a new P.O. central exchange of the latest type is being constructed at a cost of £100,000, to accommodate 10,000 lines; when this is opened, the present exchange purchased from the Corporation will be closed, as it is worked on the call-wire system, and cannot meet the increasing requirements of the service with efficiency or economy.

The Hull municipal telephone system has 2,445 telephones (1,850 lines) connected, and that at Portsmouth 2,566 telephones (1,987 lines).

The rental of private wires provided by the Post Office amounted to £195,243. The London P.O. telephone service comprised 55,125 telephones and 632 call offices, with 2,417 miles of underground pipes, and 447,797 miles of wires; 124,571 miles of wire were rented by the National Telephone Co. Royalties for telephone licences amounted to £293,828 from the National Telephone Co. and to £2,618 from other sources.

The mileage of wire in the Post Office system now amounts to 304,562 for telegraphs, 548,694 for telephones, and 193,656 for private lines—total 1,046,912 miles—of which 412,434 miles are aerial, 623,930 underground, and 10,548 submarine.

CONTRACTS OPEN and CLOSED.

OPEN.

Australia.—Victoria.—Electric lamps for the P.M.G. See "Official Notices" October 15th.

Melbourne.—February 22nd, 1910. The Postmaster-General is calling for tenders for the erection of wireless telegraph stations on North and South Heads, Sydney, and on Fremantle Heights, Western Australia, capable of communicating with ships up to 1,000 miles.

Melbourne.—Telegraph and telephone material, for the P.M.G. See "Official Notices" October 29th.

Austria.—The Austrian State Railway authorities in Innsbruck have just invited tenders for an installation of electric lighting at the railway station at Schwarzach-St. Veit.

Belgium.—December 31st. The municipal authorities of Jupille are inviting tenders for the concession for the lighting of the little town by gas or electricity.

Birmingham.—November 6th. Electric cables, lamps and sundries, for a year, for Cadbury Bros., Bourneville. (Forms Nos. 3 and 4; applications for forms to be made by letter by November 6th.)

Bolton.—A correspondent says that the Tramways Committee will, ere long, be in the market for additional cars.

Bradford.—November 13th. General stores for the Tramways Department for a year (returnable deposit of £1 1s.). Tramway Offices, 7, Hall Ings, Bradford.

Bury.—The Tramways Committee is in the market for a motor tower wagon.

Canada.—MONTREAL.—Tenders are being called by the Saraguay Electric and Water Co. for turbo-generators of 2,000 KW. capacity. Proportionate increase of power-house boilers and other equipment will be made likewise. Charles Brandeis, consulting engineer, 4, Phillips Place.

OTTAWA.—November 25th. Tenders are invited for the packing of material and supplies for points along the Yukon telegraph line between Quesnelle and Atlin, in the course of the season of 1910, 1911 and 1912. See this column for October 29th.

NELSON.—The street railway by-law was carried almost unanimously. The company's plans as to initial equipment and extension comprise:—Motor-generator set, including sheds, switchboard, and necessary cable from sub-station to trolley lines, $11,000; two double-truck four-motor cars and two trailers, $12,000; car barns, machine shop, and full line of repair parts, $2,500; rotary broom, and apparatus necessary to attach same, $1,200; belt-line extension, $16,000; total, $43,700.—*The Canadian Engineer.*

Doncaster.—November 8th. Laying steel rails, permanent way construction, for two additional tramway passing-places, Bentley route, for the T.C. Borough Surveyor.

Dublin.—November 29th. General stores for the Dublin United Tramways Co. (1896), Ltd. See "Official Notices" to-day.

Dundee.—The Corporation electricity department invites offers for the supply of a motor vehicle suitable for dealing with the transference of stores, &c. W. H. Blyth Martin, Town Clerk.

Eccles.—A correspondent understands that the Electricity Committee is in the market for electric heating apparatus.

Edmonton.—November 23rd. Electric light and power installation at the new infirmary. See "Official Notices" to-day.

Germany.—November 13th. The State Water Engineering authorities at Brunsbuttelkoog are inviting tenders for the supply of 24 electrically-operated centrifugal pumps.

November 15th.—The municipal authorities of Forbach are inviting tenders for the construction of an electric tramway in the town.

India.—LUCKNOW.—December 31st. The Municipal Board invites proposals for supply of electrical energy, coal or oil gas. See this column for October 29th.

London.—L.C.C.—Covering with asbestos tape about 2¾ miles of lead-covered high and low-tension electric cables in manholes. See "Official Notices" to-day.

Mexborough.—November 6th. Wiring skating rink. (Returnable deposit, 2s. 6d.) J. Willis, jun., 100, High Street, Mexborough.

Sherburn (Co. Durham).—November 6th. Electric light installation for the main portion of the parish, for the P.C. A. Stanley, clerk, Leamside, Fence Houses.

Turkey.—November 30th. The municipal authorities of Broussa are inviting tenders for the concession for the establishment of a central electric lighting station and a system of electric tramways in the town.

Warrington.—November 19th. Telegraph materials for a year, for the Cheshire Lines Committee. S. Saxon Barton, Stores Superintendent, Cheshire Lines, Warrington.

CLOSED.

Bury.—The Electricity Committee has accepted the tender of Messrs. E. Green & Sons, Ltd., for economisers for the works.

Canada.—TORONTO.—The contract for one 650-KW. 120-R.P.M. engine-type alternator, together with switchboard, steam driven exciter and motor-generator set, has been awarded to the General Electric Manufacturing Co., of Sweden, through their representatives, Messrs. Kilmer, Pullen & Burnham, Toronto.

CALGARY.—The order for four 750-KVA. water-cooled step-down transformers for the Calgary Power and Transmission Co. has also been awarded to the General Electric Manufacturing Co., of Sweden, through the same firm.

The contract for about 8,000 lb. of wire, for the balance of this year's electric light work at Calgary, was let to the Canadian General Electric Co., who have just opened a branch in Calgary, at $17·20 a hundred, with a discount allowance of the half of 1 per cent. for 30 days' cash. The tender of the North-West Electric Co. was $17·70 with no discount, and that of the Enterprise Electric Co. $18·50. All these prices are f.o.b. Calgary.—*The Canadian Engineer.*

Electric Crane Contracts.—Messrs. Royce, Ltd., Trafford Park, Manchester, report that they have recently booked the following orders:—Two 45-ton overhead electric cranes for Canada; two 125-ton electric cranes for a Japanese Dockyard; and 23 electric capstans for the Clyde Navigation Trustees, 14 of the latter being of the "Royce" patent free barrel type.

Heywood.—The Electricity Committee has accepted the tender of Mr. Thomas Hollinrake for 2,000 tons of coal.

Portsmouth.—The T.C. has accepted the tender of the British Thomson-Houston Co. to supply 8-C.P. and 16-C.P. incandescent lamps for the ensuing 12 months, at 5s. per dozen.

South Africa.—DURBAN.—At the Council meeting held on October 7th the tender of Messrs. C. A. Parsons & Co. was accepted for the supply of a turbo-generator set, at a cost of £6,250.

The following tenders were also accepted for cable:—

Henley's Telegraph Works Co.—1,200 yards ·75 sq. in. L.T. cable, at £509; 7,000 yards ·25 sq. in. L.T. cable, at £1,185.

A.E.G. Electric Co.—330 yards ·5 sq. in. vulcanised rubber cable, at £142.

Stockport.—The T.C. has accepted the tender of Messrs. W. A. Shaw & Co., of 6, Warren Street, Stockport, for electrical supplies to the sewage outfall works.

Turkey.—CONSTANTINOPLE.—According to a special dispatch from Constantinople to the *Financial News*, it is now reported that among the firms which have submitted tenders for the construction of the telephone installation (to which we recently referred in "Notes on Trade Abroad") are the following:—Antwerp Telephone Co., Antwerp; Deutsche Telephonwerke, Berlin; Siemens & Halske, Berlin; Milde et Fils, Paris; Brenon, Paris; Société Générale de Télégraphic de l'Est, Constanka; Skon Skirakian, Constantinople; and several English firms. "No decision has been arrived at yet by the Turkish Government, but it is said that the offer of a French firm is likely to be accepted."

Wordsley.—Staffs. Education Committee has accepted the tender of Messrs. Whittaker Bros., of Dudley, for installing the electric light at Wordsley Schools, at £84, and for mains, at £17.

FORTHCOMING EVENTS.

Association of Teachers in Technical Institutions.—Saturday, November 6th. At 8 p.m. At St. Bride Institute, E.C. Annual meeting.

Institution of Mechanical Engineers (Graduates' Association).—Monday, November 8th. At 8 p.m. Paper on "The Commercial Testing of Railway Materials," by Mr. T. H. Sanders.

Institution of Electrical Engineers (Manchester Students' Section).—Tuesday, November 9th. At 7.30 p.m. At the Mosley Hotel, Manchester. Supper and smoking concert.

Institution of Civil Engineers.—Tuesday, November 9th. At 8 p.m. Papers on "The Single-phase Electrification of the Heysham, Morecambe and Lancaster Branch of the Midland Railway," by Messrs. J. Dalziel and J. Sayers; "The Equipment and Working Results of the Mersey Railway under Steam and Electric Traction," by Mr. J. Shaw; and "The Effect of Electrical Operation on the Permanent-way Maintenance of Railways, as illustrated on the Tynemouth Branches of the North-Eastern Railway," by Dr. C. A. Harrison.

Institution of Electrical Engineers (London).—Thursday, November 11th. At 8 p.m. Opening meeting. At the Institution of Civil Engineers. Presidential address by Dr. Gisbert Kapp.

Institution of Electrical Engineers (Birmingham Section).—Friday, November 12th. At 7 for 7.15 p.m. At the Grand Hotel, Birmingham. Annual dinner.

Physical Society.—Friday, November 12th. At 8 p.m. At the Imperial College of Science, South Kensington, S.W. Paper on "Some Further Notes on the Physiological Principles underlying the Flicker Photometer," by Mr. J. S. Dow, and other papers.

Junior Institution of Engineers.—Tuesday, November 16th. At 8 p.m. At the Royal United Service Institution, Whitehall. Presidential address, on "Recent Warship Machinery," by Engineer Vice-Admiral H. J. Oram.

Illuminating Engineering Society.—Thursday, November 18th. At 8 p.m. At the Royal Society of Arts, 18, John Street, Adelphi, W. Opening meeting. Inaugural address by Prof. Silvanus P. Thompson, D.Sc., F.R.S., first President.

THE ELECTRICAL ENGINEERS
(LONDON DIVISION).

THE following orders are issued for next week:—

Commanding Officer—COL. R. E. B. CROMPTON, C.B.

Monday, November 8th.—"A" Company. Technical drill, 7 to 9.30 p.m.

Tuesday, November 9th.—"B" Company. Technical drill, 7 to 9.30 p.m.

Wednesday, November 10th.—Gymnasium, 6.30 to 9.30 p.m.

Thursday, November 11th.—"C" Company. Technical drill, 7 to 9.30 p.m.

Friday, November 12th.—"D" Company. Technical drill, 7 to 9.30 p.m.

Saturday, November 13th.—"A" Company. Week-end run at Coalhouse Fort. Parade at Fenchurch Street station at 3 p.m. Dress: khaki, with haversack and greatcoat; knife, fork, and toilet requisites to be carried in haversack. Tickets will be issued at the station before entraining.

(Signed) P. H. CAMPBELL, Capt. R.E. and Adjutant,
For O.C. E.E., L.D.

NOTES.

Inquiries.—A correspondent wishes to obtain grinding machinery to convert a previously crushed crystal into a material of the consistency of French chalk.

The makers of "Chain-o-lite" lamps are asked for—a series of spherical and oval lamps hooked together in the form of a chain.

The Batti-Wallahs' Smoker.—The first smoking concert of the P. & O. Batti-Wallahs' Society was held at the Holborn on Monday, November 1st, Mr. C. L. Lichtenberg appropriately being in the chair. A most pleasant evening was spent, and Mr. Walter Waters delighted the audience with his humorous song, "What's the Use." Mr. Davis rendered "A Farewell" excellently. Our old favourite, Miss Annie Bartle, was there, and Miss Mary Strangeways, while Miss Saidee Hamilton supplied humorous songs. Nor should we omit mention of Mr. Jas. Davis, Mr. Chas. Wreford and Mr. Harry Heap, all of whom, with Mr. Jack Treval, combined to make a full evening of song and humour such as we now expect at the meetings of this Society, which are always pleasant and free from stiff formality.

Tramway Accident and Its Sequel.—Some time ago a man was knocked down by a tramcar in the Harrow Road, and killed. The jury returned a verdict of "Accidental Death," but the tramway company discharged the driver, a man named Smales. A 16-year old son of the latter was overcome by the thought of the poverty which stared the family in the face, and after returning from church on a Sunday night, he committed suicide on the railway, leaving behind a pathetic letter, stating that he did it in the belief that the publicity that would be secured would obtain redress for his father. It was reported a few days later that the Metropolitan Tramway Co. had sent for Smales, and had given him work as an examiner of tramcar motors at the depôt.

Gas Out.—Last week a turncock, intending to cut off the water supply in a Sunderland street, turned off the gas instead, depriving the centre of the town on the south side of the river, as well as Monkwearmouth, Roker and Fulwell, of the supply, shortly after 6 o'clock in the evening. The mistake was rectified in a few minutes, but its consequences persisted for a much longer period. All gas lamps went out, in the streets and indoors; the former were relighted by the gas company's men, but great alarm was occasioned in houses, especially where the owners had gone out, leaving fires and lights burning. It was at once realised that, the gas having been turned on again unlighted, explosions in such houses would be inevitable unless immediate steps were taken to turn off the taps, and in many cases, says the Sunderland *Daily Echo*, neighbours in fear for the safety of their own houses got into vacant premises and turned the gas off. Fortunately, no serious results were reported, but it is obvious that widespread disaster might easily have occurred. No such risks attend the temporary interruption of a supply of electricity, nor could it be brought about by a careless turncock.

Institution and Lecture Notes.—North of England Institute of Mining and Mechanical Engineers.—On Saturday, October 23rd, a party of members visited the works of Messrs. J. H. Holmes & Co., Newcastle-upon-Tyne, to inspect the works, and in particular to examine a selection of mining electrical machinery. This included a 20-H.P. haulage gear fitted with a slip-ring motor and speed control device, a number of squirrel-cage motors suitable for mining purposes, auto-transformers and starters. A special feature was made of the Holmes-Page patent three-pole switch and fuse pedestal, which has been designed especially to meet conditions of mining practice, and is of the interlocked type.

On Saturday last the members of the Glasgow University Physical Society visited the Blythswood laboratory and museum, Renfrew, which was founded and equipped by the late Lord Blythswood.

Glasgow Technical College Scientific Society. — On Saturday last Mr. A. G. Collis, A.M.I.E.E., read a paper on this subject, in the course of which he referred to the indifference to danger shown in many switchboard designs, and emphasised the strange ideas of economy prevalent in some stations, where the cost of the switchgear was cut to the lowest possible amount, although such extravagances as oak pannelling and mosaic floors were considered necessary.

Association of Teachers in Technical Institutions.—The annual meeting of this Association will be held to-morrow, November 6th, at the St. Bride Institute, Fleet Street, E.C. The chair will be taken by Mr. J. Wilson, who is to be President of the Association for the coming year. The annual report of the Council will contain an abstract of the educational and professional work accomplished during the year, including the consideration of such questions as syllabuses in Applied Mechanics and Electrical Engineering, the Training of Craftsmen, the Preliminary Training of Technical Students, and Higher Education in London. Amongst professional matters dealt with are registration of teachers, superannuation, legal matters and a minimum scale of salaries for teachers in technical institutes.

Royal Society of Arts.—Sir William White, the chairman of the Council, will open the new Session of the Society on November 17th, with an address, the subject of which will be "An Imperial Navy." Among the arrangements for meetings before Christmas are papers by Mr. T. Thorne-Baker on "Photo-Telegraphy," and the Hon. Richard Clere Parsons on "Resilient Wheels for Vehicles." There will be one course of Cantor Lectures by Mr. Charles C. Turner, who will give a popular account of the progress which has been made in aeronautics.

Institution of Electrical Engineers.—At the opening meeting on November 11th, a marble bust by Hamo Thornycroft of the late Dr. John Hopkinson, F.R.S., who was president in 1890 and in 1896, will be presented to the Institution by Prof. Bertram Hopkinson, on behalf of his mother, Mrs. John Hopkinson.

Institution of Electrical Engineers (Leeds).—On Wednesday last week Mr. W. M. Rogerson, chairman, delivered his inaugural address, which consisted mainly of a retrospect of progress made in connection with electricity supply for lighting, power and traction. On Wednesday, November 17th, a paper is to be read by Mr. W. T. Maccall on "Some Experiments on Single and Stranded Fuses."

Junior Institution of Engineers.—The annual general meeting of this Institution was recently held at the Royal United Service Institution, Whitehall. The Council's annual report, which was presented, showed that the membership had increased to 1,063. Nine ordinary meetings had been held, and 39 visits to works made, covering practically every branch of engineering. The Summer meeting in the Midlands had proved very successful. Birmingham had been made the centre on account of the Institution's first local section having been established there during the year. Mr. Geo. T. Bullock was elected chairman. The benevolent fund accounts showed that the amount standing to its credit was £189. A paper was then read by Mr. T. A. Watson, A.M.Inst.C.E. (member), on "The Reinforced Concrete Construction of the New General Post Office Buildings, London." On November 16th, Engineer Vice-Admiral Henry J. Oram, C.B., will deliver his presidential address on "Recent Warship Machinery."

Institution of Municipal Engineers.—The roll of the Institution now numbers 719. It is considered advisable that a class of associate members be attached to the Institution, such associate members to be entitled to the privilege of corporate membership, and a clause in the by-laws in respect thereto is under consideration.

N.E. Coast Institution of Engineers and Shipbuilders.—The new session opened on 29th ult. The report of the Council showed that the roll of members numbered 1,037. A paper on "Marine Boiler Design" was read by Mr. D. Myles, vice-president.

Royal Institution.—The Christmas Course of Juvenile Lectures will be delivered this year by Mr. William Duddell, F.R.S., his subject being "Modern Electricity." The course, which will be experimentally illustrated, commences on Tuesday, December 28th, at 3 o'clock, and will be continued on December 30th, 1909, January 1st, 4th, 6th and 8th, 1910.

Late Legal.—Litholite, Ltd., *v.* Hall.—In the Shoreditch County Court on Tuesday, before his Honour Judge Bray, Messrs. Litholite, Ltd., of 55, Hackney Grove, N.E., manufacturers of electric insulators, sued Mr. R. F. Hall, of 137, Suffolk Street, Birmingham, consulting engineer, for £30, money expended and work done in connection with dies for electric insulators. The plaintiffs' case was that they supplied insulators made of litholite, which was a cheap substitute for vulcanite, to customers. They took an order from the defendant, he supplying the thing he required, from which they made the dies. When they had finished the work, however, he complained that the litholite was unsuitable for what he required the insulators for, as it "roughened up." They offered to put any defect right, as they were convinced their goods were of the best, but the matter dragged on until they were forced to sue. The defendant appeared in person, and said that when the traveller called upon him, he told him that he had got a special job on, and showed him what it was, asking him at the same time if he considered litholite would answer the purpose. He was assured that it would, and on that understanding he ordered the stuff, but he now found it of no service at all. He asked the plaintiffs if it was not a fact that they had some trouble with the Electrical Ignition Co. in a similar way. Plaintiffs' representative said it was not so. They supplied some insulators, and after they had been used, the company complained of leakage of current across the surface. They could not make out what had caused it, and it was some time before they discovered that there was a thin coating of lacquer on the litholite which contained carbon, and caused the surface leakage. They were under the impression at first that it was the dies that were wrong, but so soon as they found out the cause of the leak they paid £15 to the Electrical Ignition Co., the whole of the cost they had been put to. That defect had now been remedied. The defendant said he had had to pay compensation to the people to whom he had supplied the goods, and he considered it very hard on himself. He was prepared to call witnesses as to this, and also expert evidence, but a little later counsel for the plaintiffs mentioned to his Honour that the defendant was more inclined to settle the matter on the spot, and judgment was entered for the plaintiffs for £12, with £20 costs.

Fires at Cable Factories.—On Wednesday morning a fire broke out at the works of Messrs. Connolly Bros., Ltd., of Manchester. Although rather serious damage resulted, the firm are making arrangements so that little delay will be occasioned in the execution of orders, as they are able to utilise their branch works in place of the portion damaged.

It is reported in the daily Press that on Saturday morning last a fire occurred at the Victoria Works, Charlton, of Messrs. Johnson and Phillips, Ltd. One of the buildings used in one of the processes of cable manufacture is said to have been burned out, but an adjacent building used as a strand shop was saved.

To-day's Great Thought!—M.D. doesn't mean "medical doctor." It stands for "Merry Devil."—Dr. Walford Bodie, M.D., Ph.D, D.Sc.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the Electrical Review *posted as to their movements.*

Central Station Officials.—Mr. J. Wright, the senior shift engineer to the Hounslow electricity undertaking, has resigned, and his place has been filled by the promotion of Mr. Golding, second engineer. Mr. Woods, third engineer, has been given the second engineer's position, and Mr. Fletcher, of the Nottingham and Derbyshire Power Co., has been appointed third engineer.

At Thornhill, recently, Mr. A. E. Wainwright, of the Yorkshire Electric Power Co., was presented with a Gladstone bag by the members of the staff on the occasion of his leaving the service of the company. Mr. Wainwright takes up the position of engineer-in-charge to the Stalybridge Corporation.

We understand that Mr. Oswin Hanson, the electrical engineer for the Fleetwood Council's recently acquired electric light and power undertaking, has been appointed general manager of the Liverpool and District Electric Lighting Co.

The staff of the Bridlington Electricity Works have presented an oak clock to Mr. H. W. Haugh, mains foreman, on his marriage.

The Wrexham T.C. has increased the salary of Mr. W. J. Pickvance, electrical engineer, from £225 to £250 per annum, as from April 1st.

Mr. G. Francis, A.M.I.E.E, rolling stock superintendent with the Hastings Tramway Co., was presented with a gold watch by the work staff, on the occasion of his leaving the company's service.

General.—It is announced that Mr. Mervyn O'Gorman has been appointed by the War Office to undertake the organisation of the construction department at Aldershot for the manufacture of engines for dirigible airships and aeroplanes.

Mr. Kicki Kobori, chief electrical engineer of the Nji River Electric Co., at Kyoto, Japan, was at Niagara Falls last month, inspecting the works of the power companies, with a view to gathering information as to the installation and operation of power plants. The *Canadian Engineer* says that his company will construct the biggest plant in Japan.

Mr. G. W. Farrall, a member of the works staff of the Electric Construction Co.'s works at Bushbury, Wolverhampton, was last week presented by the workmen of the Brush-gear department with a smoking cabinet on his retirement after being employed at the works over 20 years.

Mr. I. E. Winslow is removing his offices from 20, Bishopsgate Street Within to 8, Crosby Square, E.C., as from the 8th inst.

Obituary.—The Late Mr. Medhurst.—The inquest was held on Thursday last week into the death of Mr. F. Hastings Medhurst, which was referred to briefly in our last issue. A personal friend said that the deceased gentleman "burned the candle at both ends always," and in 1904 he was persuaded to go to Canada for his first holiday, after at least 10 years' hard work. The evidence given by Mr. Medhurst's father showed that he had several times tried to persuade him not to overwork himself. He was most ambitious. He had been suffering from sleeplessness, and frequently after working all day had made night trips to Stafford in connection with his candidature. In a letter to the hotel landlord, Mr. Medhurst asked that the cash found upon him should be divided between the waiter and chambermaid at the hotel, and that his cigarette case should be given to his valet. The jury returned a verdict of "Suicide during temporary insanity," and expressed their sympathy with the relatives.

Mr. John E. Pitcairn.—We regret to record the death, at the age of 59 years, of Mr. J. E. Pitcairn, J.P., who retired from active service under the Edinburgh Tramways Co. in 1906, after being manager for 22 years.

Mr. W. I. Buchanan.—Shareholders and others interested in the British Westinghouse Electric and Manufacturing Co., Ltd., will have learned with regret of the sudden death in London last month of Mr. W. I. Buchanan, who was for a time chairman of that company. Mr. Buchanan was a man of fine presence and personality and one of the best types of American statesmen. For several years he acted as deputy-chairman of the company and as a director of some of its associated companies.

CITY NOTES.

Cape Electric Tramways, Ltd.

In their report for the year ended June 30th, 1909, the directors state that the profit and loss account, after providing for debenture interest and redemption of debentures, and taking into account the balance brought forward from last year, shows a balance to credit of £5,955, which has been carried forward. During the year the tramways carried in Cape Town 11,888,180 passengers, earning £117,715, against 14,742,155 passengers, earning £120,910 in the preceding year. In Port Elizabeth 2,978,217 passengers were carried, earning £31,455 against 3,561,211 passengers, earning £37,048 in 1907-8. The dividends declared by the sub-companies amounted to £47,029, against £46,081 last year. This result has been obtained by stringent economies in the working of the undertaking, and in spite of a decreased traffic. The Cape Town system shows an improvement in the profit earned over last year. This increase is unfortunately almost counterbalanced by the decreased earnings of the Port Elizabeth system. In the month of November of last year, a disastrous flood occurred in Port Elizabeth owing to the overflowing of the Baakens River. This catastrophe caused considerable damage to the rolling stock, power station and other buildings, amounting to nearly £6,000. Of this amount £4,667 still remains to be charged against the future profits of the Port Elizabeth tramway, it being decided that this exceptional loss should be spread over a period of years. The financial depression in Port Elizabeth has been most acute; and in Cape Town, although no marked improvement was shown, the results that are now coming forward are encouraging to the extent that the returns have begun to give indications of a gradual increase, which can reasonably be expected to be sustained, as local conditions all point in that direction. The directors place on record their highest appreciation of the services rendered by the local boards in Cape Town and Port Elizabeth, by Mr. A. S. Giles, and Mr. J. A. Barkley, the general managers, and by the staff under them.

In an accompanying report, Mr. A. S. Giles, general manager of the Cape Town companies, says: "The gross profit shows an improvement on last year, and has been due to reduced working expenses, and notwithstanding the fact that the total receipts show a falling off as compared with last year. The following table gives the traffic returns for the past three years:—

Year ending June 30th.	Mileage.	Passengers.	Receipts.	Aver. receipts per car-mile.
1907 ..	2,074,656	12,563,303	£131,594	15 22d.
1908 ..	2,185,103	14,742,155	£120,909	13·28d.
1909 ..	1,874,802	11,888,180	£117,714	15·07d.

The two routes, Southern Suburbs and City, show a substantial increase in traffic, while the other routes, especially the residential lines within the City of Cape Town, show a large decrease. The public residing in the suburbs continue to make use of the increased facilities given them by the increased length of the stages and the adoption of cheaper fares between Mowbray and Wynberg. The traffic between Claremont and Cape Town has much improved by the extension of the 6d. cash stage from Westerford Bridge to a point near Station Road, Claremont, and it is this traffic which has increased the receipts on the Southern Suburbs and City lines. The serious decrease on the Gardens route, more especially Kloof Street, Tamboers Kloof, and Oranjezicht, is the result of continued bad times, and shrinkage of population. Traffic on the Sea Point line has been, of course, very much less than in the previous year, but, with a smaller service of cars, and consequent reduced expenditure, we have earned a better return on this route, although the total receipts are a little lower than last year. The actual working expenses for the year amounted to £78,623, and compare favourably with previous years.

Year ending June.	Mileage.	Expenses.	Average per car-mile.
1907 ..	2,074,656	£86,940	10·05d.
1908 ..	2,185,103	£88,656	9·73d.
1909 ..	1,874,802	£78,623	10·06d.

The car-miles run during the current year are considerably less than in previous years, for, on account of the continued falling-off in receipts, the service of cars has had to be reduced to effect economies. This reduction of mileage has caused the average cost per mile to exceed the average of the previous year. The result is due to the fact that the standing charges do not vary in proportion to the mileage; these have to be met, and are practically the same as last year, when the mileage was 16 per cent. greater. The power costs for the year average 1·0398d. per kw.-hour, a figure lower than any obtained in previous years. The plant has been well maintained throughout and is in good working condition. Notwithstanding the reduced output, economies have been achieved in fuel consumption, and the total costs have been reduced largely. The permanent way throughout the system has been properly maintained. During the year, the asphalt paving in Long Street and in Darling Street was completed, and these routes, it is hoped, will require but little upkeep for many years to come. The cars have been overhauled and repaired, and thoroughly kept in working condition. The result of careful inspection and testing, and a system of metering the current consumed by each car, has had the effect of lowering the cost of energy per car-mile. I anticipate reduced cost of car repairs during the ensuing year by the system I have now adopted."

A matter which at one time during the year assumed serious dimensions arose by the Cape Divisional Council bringing an action against the Southern Suburbs Co., requiring extensive alterations to the track between Mowbray and Wynberg. The ruling of the Court couples with it a sort of compromise, and calls upon the company to carry out certain works at the points along the tramway which are considered dangerous. These works it is estimated will cost a comparatively small sum, and must be completed by March of next year.

In the report of Mr. J. A. Barkley, the general manager of the Port Elizabeth Electric Tramway Co., Ltd., it is stated:—"The business depression has increased in severity and its effects upon our revenue are deplorable. The prosperous conditions of the Transvaal and Rhodesia, and the resulting demand for labour in these Colonies, has depleted our population almost as much as the

retrenchments made in previous years. This applies to the skilled mechanic as well as to the native labour, and to so great an extent as to render it difficult to secure workmen and labourers of satisfactory quality. When a business revival does come, the local demand for help will soon be felt, and an increasing population will be the natural result. Until then no great improvement in our business may be expected. The flood of November 16th, 1908, was most disastrous to your property, severely damaging as it did our entire equipment and buildings, but also seriously disorganising our service. This is particularly noticeable in our November and early December returns, and accounts for a substantial part of our decrease in revenue. The loss sustained on this account was £5,749." The operating expenditure for the year totals £21,579, which includes the following extraordinary expenditure:—Flood losses written off, £1,050; smoke stack losses written off, £359; total, £1,409; which brings the real operating expenditure down to the sum of £20,170.

Metallic Seamless Tube Co., Ltd.—The accounts show a net profit of £1,170, plus £4,540 brought forward. A dividend of 7½ per cent. on the ordinary shares is recommended, carrying forward £4,157.

Eastern Extension, Australasia and China Telegraph Co., Ltd.—The report for the half-year ended June 30th shows gross receipts amounting to £290,931, against £290,295 for the corresponding half-year of 1908. The working expenses, including £23,799 for maintenance of cables were £156,976, against £150,889 for the corresponding period of 1908, leaving a balance of £133,954. Deducting £3,068 for income-tax payable in England, and £15,048 for interest on debenture stock, £115,838 remains as the net profit for the half-year. After adding £18,005 brought forward, there is an available balance of £133,844. After paying two quarterly interim dividends of 1½ per cent. each, amounting to £75,000, a balance of £58,844 is carried forward.

Norwich Electric Tramways Co., Ltd.—The directors recommend a dividend for the past year at the rate of 1½ per cent. per annum (against 1½ per cent. last year), less income-tax. £500 is placed to reserve and £198 carried forward.

Stock Exchange Notices.—The Committee has appointed special settling days as under:—

November 8th.—Marconi's Wireless Telegraph Co.—Further issue of 10,000 7 per cent. cumulative participating preference shares of £1 each, fully paid, Nos. 625,081 to 635,080.

November 9th.—Marconi's Wireless Telegraph Co.—Further issue of 50 7 per cent. cumulative participating preference shares of £1 each, fully paid, Nos. 635,081 to 635,130.

November 10th.—Marconi's Wireless Telegraph Co.—Further issue of 2,232 7 per cent. cumulative participating preference shares of £1 each, fully paid, Nos. 635,131 to 637,362.

November 11th.—Marconi's Wireless Telegraph Co.—Further issue of 10,782 7 per cent. cumulative participating preference shares of £1 each, fully paid, Nos. 637,363 to 648,144.

November 12th.—Marconi's Wireless Telegraph Co.—Further issue of 4,505 7 per cent. cumulative participating preference shares of £1 each, fully paid, Nos. 648,145 to 652,649.

And ordered the undermentioned securities to be quoted in the Official List:—

Rosario Electric Co.—Further issue of 2,563 6 per cent. cumulative second preference shares of £5 each, fully paid, within Nos. 15,001 to 20,000.

Electrolytic Alkali Co., Ltd.—The annual meeting of this company was held at Liverpool on October 28th. Colonel Lee Pilkington, the chairman, in moving the adoption of the report, said (as reported in the *Financial Times*) that the increase of £20,333 in the trading account was gratifying and was the result of large sales. The price of the company's principal products, however, was still abnormally low; otherwise the result of the year's trading would have been eminently satisfactory to all the shareholders. The net profit for the year was £11,919, against £10,411 in the previous year. The figures in all departments proved that the company was making progress, especially considering the dulness of the trade. The disposal amount at profit and loss account was now £22,174, as against £17,252 last year, and that was more than sufficient to discharge all the accumulated arrears of dividend on the preference shares. Nevertheless, the directors, after giving the matter full consideration, had deemed it prudent to recommend a payment of one year only, which would leave to carry forward £15,177, or nearly £5,000 more than in the previous year. In the present bad state of trade they considered it wise to keep a large balance in hand against any contingencies that might arise. The report was adopted, with five dissentients.

Prospectus.—*Lumut Rubber Estates, Ltd.*—An issue of 150,000 shares of £1 each at par has been offered to the public this week. The company will acquire the Sungei Wangi and Riverside Estates, in the State of Perak.

Companies Struck off the Register.—The following have been struck off the register, and are accordingly dissolved:—

Anglo-Iberian Electric Light and Power Co., Ltd.
Carl Oppermann Electric Carriage Co., Ltd.
Electric Carriage and Storage Co., Ltd.
London Electric Supply (Joint Committee), Ltd.

Change of Address.—The Norwich Electric Tramways Co., the Coventry Electric Tramways Co., and the New General Traction Co., Ltd., are, on 8th inst., removing their offices from Bishopsgate Street Within, to 8, Crosby Square, E.C.

Rosario Electric Co., Ltd.

THE seventh annual general meeting of the shareholders of this company was held on Tuesday at River Plate House, Finsbury Circus, Mr. W. T. Western presiding.

The CHAIRMAN, in moving the adoption of the report (see ELECTRICAL REVIEW, October 15th, page 627), said the accounts showed continued progress. The units of current sold were 32 per cent. in excess of those sold in the preceding year, about one-fourth of which was for power, as against one-fifth in the previous year. The gross receipts had increased from £73,100 to £91,300. They had received slightly less per unit consequent upon the larger proportion used for power and public lighting. Their works costs of running were very nearly the same as last year, which, at first sight, seemed an anomaly. The explanation was that, in the previous year, the company bore the cost of trimming the street lamps in respect to the street lighting. This year the Municipality had borne those charges, paying them for the current used only. Making that correction, their cost of working had gone up by £1,900—the smallness of the figure being accounted for by the lower prices of fuel, and still more so by the benefit they had obtained by using their own condensing plant. After providing for depreciation, there remained £35,000, as against £23,000 last year. Last year they had to provide for £1,700 special charges, which did not recur on this occasion; and they were enabled to pay a dividend of 8 per cent. on the ordinary shares, and to place £15,000 to the reserve, making that fund £30,000. He trusted the shareholders would consider those results satisfactory. Their relations with the municipal authorities had been harmonious. They had expended £33,700 on capital account, which included the completion of their condensing plant and about £13,000 for additional mains. He had only recently returned from a visit to Rosario, where he went specially on the business of the company, in order that he might study on the spot the lines of future development. It was only four years since his last visit, and the development of the town in that time had been remarkable—it might be summed up in the statement that the population had increased by something like 20 per cent., and that the conveniences of the town in the way of paving, lighting, water supply and tramway service had all been improved. If there was a fly in the ointment, it was that municipal taxation had increased to an extent which had caused a general protest in a vigorous form. He had the great advantage of the presence of Mr. Merz, who was in the Argentine on other business, and who inspected their station, and gave them the benefit of his counsel. He also met the members of their Advisory Committee, and consulted with them. The important point to decide was as to the lines of development. At their present station they had room for more plant, which might be sufficient to provide for their business increasing at a normal rate for two or three years, and which might, by a rearrangement of the plant, and at considerable cost, be made to last for another four or five years. In view of the general development of the town, he thought they ought to look ahead for a longer period. They had, therefore, agreed to purchase some land at Sorrento, just outside the municipal boundary, having an area sufficient to last them for many years. Upon the site they contemplated erecting a turbine plant of the latest pattern, with its proper equipment of condensing plant. That would cost £100,000 to £120,000 for the station, to which would have to be added the cost of cables and transformers, making in all, perhaps, £200,000. That would give them a station about equal to their present one, or, say, double their present effective capacity. It might seem a large sum to expend in the course of the next three or four years, and was a departure from their past policy of looking ahead to next year's demand only, but he was convinced that it was no longer sound policy to take short views, and that the policy of at once commencing to erect a new station was preferable to filling up their existing site to its possible maximum capacity and postponing the inevitable construction of a new station. Towards the cost of dividend on the new capital expenditure they already had a considerable margin of revenue, and, given a continuous growth of business even at a lower ratio than they had experienced in the past, he saw no reason to fear any reduction in the present dividends. Towards meeting the expenditure they proposed to call a special meeting shortly to sanction an issue of £100,000 new ordinary shares. As to the current year, he was pleased to say that the profits for July and August—which, of course, it was important to remember were their winter months—were over £3,000 in excess of the corresponding two months of last year.

MR. W. F. LEESE seconded the motion.

The CHAIRMAN, in reply to a shareholder, said that the metallic-filament lamp was coming into use in the Argentine, but not to the extent that was the case at home. He rather fancied that that was because the quality of the lamp sent out was not a particularly good one. For a time, no doubt, it would tend to reduce consumption, but in the end he believed it would be to their advantage, and, personally, he was always in favour of the consumer using the lamp that would give him the best results with the smallest amount of consumption.

The report was adopted.

City of Buenos Ayres Tramways (1904), Ltd.—The directors announce a dividend of 1s. 3d. per share, less income-tax, for the three months ended September 30th last.

West African Telegraph Co., Ltd.—The directors have declared an interim dividend of 4 per cent. per annum, free of income-tax, for the past half-year.

Cleveland and Durham Electric Power, Ltd.

The annual meeting was held in Newcastle-on-Tyne on October 27th. The Chairman (Mr. Charles Emmott) moved the adoption of the report (see Electrical Review, October 22nd, p. 667). Dealing first with the balance sheet, he said, that the share capital remained the same as last year. An additional sum of £10,000 had been raised by first mortgage debentures, and further financial arrangements had resulted in the creation of 6 per cent. second mortgage debentures to the amount of £150,000. Of these they had placed £111,500, £75,000 of which had been taken up to date, and the balance of £36,500 would be issued as occasion demanded. The total amount due to creditors was, this year, £78,097, a decrease of, roughly, £31,000, as compared with last year—a satisfactory feature. Turning to the investments and loans, he said these had been increased, roughly, by £8,000—from £837,607 to £845,594—due to a further advance to their subsidiary company, the Northern Counties Electricity Supply Co., Ltd. The capital expenditure on works had been rather over £14,000, and had been spent chiefly on the erection and equipment of additional sub-stations. That was the smallest amount they had spent on capital account in any 12 months, and it reflected the bad state of trade in the district. During the previous year they had spent about £46,000 in that direction. There was an increase in the amount due from debtors to the company for current supplied, &c, of £8,800, the total due this year being £45,993, as against £37,109 at the corresponding date last year. With regard to the item of deferred shares that increased by £1,085, and completed the option which he had explained fully at their last meeting. He came now to the profit and loss account. At first sight the result of the year's trading did not appear to compare favourably with that of the previous 12 months. Dealing first with the receipts they would notice that the revenue was this year £68,457, as compared with £73,328 shown last year. The outstanding feature of the year as affecting the company's business, had been the increased depression in trade, which had been more severe during the period covered by the accounts than for very many years past. During the previous year they had felt the influence of strikes, which continued into the year under review, and trade consistently got worse. This had been reflected in the balance-sheets of nearly every industrial undertaking in the district, and generally to an extent much more noticeable than in their own, for, whereas their loss, after deducting debenture interest, was under £5,000, other companies had either lost or reduced their profits by a sum many times that figure. Trade depression had a three-fold effect on an industry such as theirs. First, it reduced the consumption of current of consumers already connected. Secondly, it retarded the volume of new business contracted for. Thirdly, it unfortunately did not permit, in their case, of a substantial reduction in working expenses, as was sometimes possible in other works where a whole department might be shut down. So far as the first two factors were concerned, it was not an unreasonable assumption that had the consumers connected consumed the amount of current which they would have used in normal times, the company's receipts would have been at least 25 per cent. greater, and if others had not delayed the completion of their installations pending trade improvement, but had changed over to electric driving with the usual dispatch, a further substantial revenue would have accrued. There were other firms again, too, which although anxious to modernise their plant, had perforce to decide upon a policy that for the time being no capital expenditure, however remunerative, should be incurred. So far as the third factor was concerned, they would appreciate that it cost very little more to run generating stations at their full capacity than it did to run at, say, half their possible output; for whether a station was run fully, or only half employed, the same staff was necessary to operate it. During the year under review the waste heat stations they operated had not been run at their best advantage. Owing to the reduction in the quantity of pig-iron produced, furnaces had been shut down, which had resulted in blowing engines being laid off duty, with a consequent reduction in the amount of steam placed at the company's disposal. A special word with regard to the electrification of collieries was necessary. They had in their area a very large number of coal mines, in fact, in East Durham and round about the district of Consett and Bishop Auckland there was practically no other industry carried on in which a large amount of power was used. In their area there were about 150 pits, most of which could, with profit to their owners and that company, be connected with the Cleveland Co.'s mains. They expected ultimately to do a very large business in that direction. The Eight Hours Act would not come into force in the counties of Durham and Northumberland until January 1st next. The owners refused to spend money until they knew what was going to happen in regard to that, but he thought that in order to increase their output in a given time, and to decrease working expenses, colliery owners would be compelled to adopt more efficient labour-saving plant. There was no doubt at all that those responsible for the management of colliery undertakings were more and more coming to realise the fact that they must make increased use of mechanical power, and that this could be applied far more conveniently and cheaply by electrical than by any other means. The use of electricity in mines was being rapidly extended all over the country, and there were many collieries in Durham which were run entirely by this form of power. While, therefore, the company's progress had been retarded for the moment, they could be sure that the considerations he had referred to would have a beneficial effect on their future results. Referring to the company's expenses, he said that they did not think that their working costs or business organisation could be improved upon. The cost of producing current was as low as the best engineering practice could get it. Summarising the last two years' trading, and taking into account only the company's permanent source of revenue, and excluding interest from their calculations, the trading results showed an improvement of £15,185. Now while there were signs that trade was improving, those best able to judge believed that it would be slow, and the directors had, therefore, thought it right to pursue a distinctly conservative policy in dealing with every item in the accounts upon which he had been commenting. They had taken no credit for any profits on uncompleted contracts with their associated companies. They, nevertheless, held strongly that that company's investments in the Cleveland Parliamentary Co. would prove a profitable one, and they had in no way modified their opinion as to the excellent area which the Tees and iron mines districts presented from a power supply point of view. They would be pleased to note that the connections with the company's system had considerably increased. All the connections were bound to lead to an increase of revenue as trade improved, and already the result showed considerable improvement for the current year as compared with the year covered by the accounts. The returns for the current year down to a fortnight ago, showed a revenue of £26,423 as compared with £20,315 for the corresponding period of last year. The profit was £4,008, as compared with £1,507. These were the combined figures for that company and its associated companies, of which that company held most of the capital. The improvement that those figures showed was a very substantial one. He did not think that he was at all over-sanguine in prophesying that with a reasonable improvement in trade, advances on those figures might be looked forward to as the year proceeded. Amongst their more important new agreements entered into were those with Bolckow, Vaughan & Co., Ltd.; Head, Wrightson & Co, Ltd.; the Salt Union, Ltd; North-Eastern Railway Co.; and the Ormesby Rolling Mills, Ltd. In addition to the improved figures which he had given them, they had room for some encouragement in the negotiations they had been able to resume with some very large power users in their area, and they were, therefore, confident that when they met them at that time next year it would be with much improved results to show.

The report was adopted.

The retiring directors (Mr. James Falconer, M.P., and the Hon. Robert James) were re-elected.

The American General Electric Co.—The *Electrical World* says that the American General Electric Co. is contemplating extensive improvements to its plants, both at Schenectady and at Lynn. It is said that contracts for two buildings have been made at Schenectady. One of the buildings, it is stated, will be 80 ft. × 400 ft. and five stories high, to be built of reinforced concrete and steel. The other is in the form of a 200-ft extension to building No. 50, which is a warehouse. The first of these buildings will be used for manufacturing purposes. In this connection it is also given out that the Lynn plant is to be extended by the erection of two mammoth new buildings at the river works. Building No. 74 will have an added length of from 300 to 500 ft., which will make the structure the largest single building for manufacturing purposes in New England. It is also understood that the employés of the Lynn plant will be increased from 9,200 to 15,000. The business of the General Electric has so materially increased that it is necessary to extend its manufacturing facilities.

Western Telegraph Co., Ltd.—The directors' report for the half-year ended June 30th, 1909, says that the revenue for the period amounted to £357,082 and the working expenses to £134,917. After providing £16,000 for debenture stock interest, and £6,743 for income-tax, there remains a balance of £199,421, to which is added £5,214 brought forward, making a total of £204,636. A quarterly interim dividend, amounting to £31,189, has been paid, £90,000 transferred to the general reserve fund, £5,000 to the maintenance ships' reserve fund, £10,000 to the marine insurance fund, and £10,000 to the land and buildings depreciation fund. The directors now recommend the declaration of a final dividend of 3s. per share, making with the interim dividends, a total dividend of 6 per cent. for the year, also the payment of a bonus of 2s. per share, both free of income-tax, which together will amount to £51,982, leaving a balance of £6,464 to be carried forward. The dividend and bonus will be payable on November 11th. Lord Richard H. Browne has resigned his seat on the board, and the vacancy has been filled by Mr. John George Griffiths.

Venezuela Telephone and Electrical Appliances Co., Ltd.—The report for the 12 months ended June 30th, 1909, states that the accounts show a profit of £7,006, plus £7,168 brought forward. After providing for the interest on debentures, there remains a balance of £4,846 to be carried forward. During the past year trade in Venezuela has been very bad owing to political changes, the renewed outbreak of plague at La Guayra and the inevitable interruptions to the telephone service caused by changing the subscribers over from the old to the new switchboard, and as a consequence the gross receipts show a falling off of £1,400. The expenses have increased by £850, chiefly owing to the cost of completing the work of conversion since September, 1908, having been charged to revenue. The conversion of the lines in Caracas is now completed, and the general manager says that the company has an absolutely first-class system. The capital outlay for the year was £1,633.

Western Union Telegraph Co.

The report for the year ended June 30th, 1909, states that there has been no change during the year in the amount of capital stock or bonded debt. The figures submitted in the report, says the *Financial Times*, are naturally favoured by a comparison with the adverse conditions of the previous year; but irrespective of this comparison, they show that the company has participated fully in the marked improvement in all lines of business which is being experienced throughout the country; 5,682,152 more messages were handled than during the preceding year, with a resultant gain of $1,958,860 in the gross revenue. An increase of 3,036 miles in the mileage of poles and cables is shown, with an increase of 23,070 miles of wire, of which 14,200 miles is copper. The number of offices has been increased to 24,321, due in part to the reopening of some of the offices temporarily closed by railroad companies. Disbursements on construction account aggregated $947,296, or $191,211 less than last year. Contracts covering 4,073 miles of railroad were closed during the year. A development since the close of the fiscal year is the sale of the company's holdings of New York Telephone Co. stock (namely, at par, $16,221,800, of which $9,733,100 is pledged to secure the convertible bonds). The plans of that company for acquiring other telephone properties involved raising an amount of additional capital by the sale to stockholders of an issue of $35,000,000 of new stock. It was thought inadvisable for the telegraph company to undertake to raise the large sum required for its proportion of the new issue, and advantage was taken of a favourable opportunity to dispose of the minority interest in the telephone company to the American Telephone and Telegraph Co. In connection with this sale, arrangements have been made for retiring on May 1st, 1912, the $10,000,000 4 per cent. convertible bonds of this company, which are redeemable at the pleasure of the company on and after that date. The revenue for the year was $30,541,073 and the expenses totalled $23,193,966, leaving a profit of $7,347,107. Interest on bonds absorbs $1,732,250 and cash dividends (2½) $2,739,436—$4,471,686. The surplus brought forward was $14,393,856, while there is carried forward $17,269,277.

Cordoba Light, Power and Traction Co., Ltd.

The directors' report states that the balance of profit as at September 30th, 1909, after meeting all charges, including interest on debenture stock, is £13,411. Out of this profit the directors recommend that a dividend at the rate of 2 per cent. (less income-tax) be paid on the shares of the company, and that the balance of £5,192 be carried forward. The company now owns the share capital of the Cordoba Light and Power Co., and the Cordoba (Argentine) Electric Tramways Construction Co., Ltd., with the exception of 10·2 per cent. of that of the Cordoba Light and Power Co. The original concession of the Cordoba Light and Power Co. for the use of the water-power of the River Primero, which would have expired in 1921, has been replaced by a new concession extending to 1948. To supplement the existing hydro-electric generating station during the periods of heavy load or shortage of water, steam plant of approximately 900 H.P. has been installed during the year, and a further addition of over 1,100 H.P. is on its way out from England. Construction of the tramways has proceeded actively, and the first section was opened to public service at the end of August with satisfactory results. In order to consolidate the position of the tramway, an agreement has been entered into for the purchase of the only important competing line. By this acquisition the efficiency of the service will be greatly increased and the expenditure upon construction distributed to greater advantage. Surveys have been made and plans are now in course of preparation for the works required to utilise the hydraulic power of another section of the river. For this purpose, and for the completion of the purchase and further construction of the tramways, additional capital will shortly be required. Two of the directors, Mr. T. Frame Thomson, the deputy chairman, and Mr. H. A. Trotter, visited Cordoba during the year.

The meeting was held on Wednesday at the offices, 62, London Wall, Sir J. Irving Courtenay in the chair.

The Chairman, in moving the adoption of the above report, said that it was the first annual meeting, and it would be useful if he recalled the purposes for which the company was constituted, and the progress which had been made. The primary object was the acquisition of the control of the Cordoba Light and Power Co.—an American Co. which had for some 12 years carried on the business of electric supply in the City of Cordoba in the Argentine Republic. That company's source of supply of energy was the River Primero, the waters of which were impounded by a dam, one of the largest in the world, built some 20 years ago by the Government of the Province of Cordoba, for the purpose of regulating the flow so that throughout the dry season of the year the water would be available for irrigation of the rich agricultural lands in the neighbourhood of the city. This regulation of the supply naturally lent itself also to the application of the hydraulic power due to the rapid slope of the river bed, in the production of electric energy for light and power. In the year 1897 the necessary works were carried out for utilising one section of the river for such purposes, and for many years the power so made available was more than sufficient for the requirements of the city. The population, however, had grown with great rapidity, and it was now an important manufacturing district, and an important commercial and railroad centre. Those causes would, of themselves, soon have sufficed to render the original installation unequal to the demand, and their action had been hastened by the restriction of the power available, resulting from the droughts from which the country had suffered during the last three years. The necessity for developing a further section of the river, and supplementing it by a reserve of steam or other mechanical power, had thus been urgent for several years past. That, however, involved a heavy expenditure of capital, and, unfortunately, the American company found itself in a difficult position for raising this new capital. The facts, however, that a considerable proportion of its capital was held in London, and that a favourable opportunity offered for associating with the light and power business an electric tramway concession (which included rights also to supply light and power) having a term of 75 years, offered a possible solution of the difficulty by the formation of this English company to control both concerns, and thus provide a basis broad enough for the financial requirements. He was happy to say that the experience they had gained during this preliminary year of the company's existence pointed to a complete justification of that policy. Naturally, they would not expect that this first year should show great results in the form of dividend. Steam plant, and especially hydraulic installations, took time to install and develop, and tramways also required a period in which to extend and reach their full yielding capacity. Undoubtedly the most important fact of the year was the securing of a 40-year concession for the American Co. That concession was the subject of long and anxious negotiation with the Government of Cordoba. He could pay to the representatives of that Government a high tribute in respect of the ability and technical knowledge which was apparent in the provisions it contained in the interests of the public. He could also congratulate them upon the fact that their subsidiary company now held a concession which not only extended the life of its business by 27 years, but placed it upon a footing of security in many respects much superior to that of the original concession. Active progress had been made in every direction during the year. Their holding in the American Co. had been increased by further exchanges of its shares for those of the new company, so that they now held 90 per cent. of its share capital. They had acquired the entire share capital of the Cordoba (Argentine) Electric Tramways Construction Co., Ltd., which owned the 75-year concession to which he had referred. They had also entered into an agreement to purchase the more important of the other two tramways, viz., the Ciudad de Cordoba Tramway, a purchase which should not only materially improve the efficiency and economy of their tramway service, but would also strengthen their position very much in relation to the supply of electric energy. They made arrangements early in the year with Messrs. J. G. White & Co. for the preparation of designs and specifications for the new hydraulic installation, the studies for which were now well advanced, and a contract was being prepared with that firm for the execution of the work. Meanwhile, provisional steam plant of about 900 H.P. had been installed; permanent steam plant of 1,100 H.P. had been purchased, and was now on its way to Cordoba, and a further 800 H.P. had been ordered for early delivery. That would provide for the growth of the electric supply business during the construction of the new hydraulic installation. Construction had proceeded actively upon the tramway, and about 4½ miles were opened for traffic at the end of August. As the power available for tramway purposes was limited, it was not possible to put more than five cars in average service. In spite of this restricted service, the traffics were most gratifying, especially as the line was opened during the winter months, which was the period of low traffics. Two miles more were ready for service, and it was expected that there would be on the average 12 to 15 miles in operation during 1910. The directors were able to recommend a dividend of 2 per cent. on the shares of the company, leaving £5,191 to be carried forward.

Mr. T. Frame Thomson seconded the motion, and the report was adopted.

Eastern Telegraph Co., Ltd.—The report for the half-year to June 30th states that the revenue amounted to £592,686. After deducting £206,055 for the ordinary expenses and £72,909 for expenditure relating to maintenance of cables, sundry differences in exchange and income-tax payable abroad, a balance of £313,721 remains, to which is added £34,435 brought from the preceding account, making a total available balance of £348,156. After providing for income-tax payable in England, interest on mortage debenture stock and two quarterly dividends on the preference stock, which in all absorb £83,087, there is a balance of £265,069, out of which the directors have placed £110,000 to the general reserve fund, and have allocated £100,000 to meet the two interim dividends of 1½ per cent. each on the ordinary stock; £55,069 is carried forward.

R. & J. Dick, Ltd.—The report for the year ended August 31st last shows a gross profit on the year's trading of £58,361; deducting income-tax and depreciation £7,197, there is a net profit of £51,163. There is to be transferred to the special reserve fund for securing payment of preference dividends £10,000. £10,000 is written off goodwill, and a dividend is to be paid on the ordinary shares for the year at the rate of 4 per cent. per annum, less income-tax.

West India and Panama Telegraph Co.—The board has declared dividends of 6s. per share on the first preference shares for the six months to June 30th, and 20s. per share on the second preference shares (on account of dividends accrued to June 30th).

ELECTRIC TRAMWAY AND RAILWAY TRAFFIC RETURNS.

Locality.	Fortnight ended.	Receipts for the fortnight. £	£*	No. of wks.	Total to date. £	£*	Route miles open.	Inc.
Aberdeen	Oct. 27	2,458	— 120	21	31,884	— 738	..	..
Ayr	,, 30	388	+ 4	24	8,915	— 99	8	..
Bath	,, 27	1,484	+ 25	43	33,775	+ 1,377	..	..
Belfast	,, 29	7,524	+ 363	29	117,149	+ 4,977	37	..
Birkenhead	,, 31	2,138	+ 23	30	33,216	— 375	13·68	..
Birmingham Corp.	,, 23	13,741	+ 865	30	196,301	+ 5,476	56·5	..
Blackburn	,, 27	2,024	— 180	31	34,838	— 1,270	14·5	..
Blackpool-Fleetw'd	,, 30	1,142	+ 424	17	20,382	+ 1,405	..	..
Bolton	,, 31	4,448	+ 72	31	78,096	— 128	26	..
Bournemouth	,, 27	2,857	+ 139	30	54,098	+ 345	21·96	..
Bradford	,, 23	9,806	+ 707	29	147,141	+ 4,275	54·81	..
Brighton	,, 31	1,764	+ 168	31	32,981	+ 1,537	9·5	..
Bristol	,, 29	10,899	+1,070	..	..	..	..	..
Brit. Elec. Trac. Co.								
Airdrie	,, 22	468	+ 4	42	9,958	— 78	3·65	..
Barnsley	,, 22	351	— 7	,,	7,118	— 363	..	..
Barrow	,, 22	478	+ 42	,,	9,893	— 611	5·37	..
Cavehill	,, 22	135	+ 6	,,	3,765	— 72	..	..
Devonport	,, 22	748	— 224	,,	15,608	— 4,046	8·85	..
Gateshead	,, 22	2,074	+ 13	,,	41,991	— 490	11·25	..
Gravesend	,, 22	438	+ 42	,,	8,979	— 70	6·5	..
Greenock	,, 22	1,137	+ 146	,,	23,684	+ 1,313	7·25	..
Hartlepool	,, 22	482	+ 52	,,	10,038	— 158	6·72	..
Kidderminster	,, 22	174	+ 8	,,	4,652	— 175	..	..
Leamington	,, 22	394	— 27	,,	7,591	+ 222	..	..
Merthyr	,, 22	396	— 23	,,	8,989	+ 8	2·9	..
Metropolitan	,, 22	13,335	+1,032	,,	263,825	+19,652	22	..
Middleton	,, 22	651	+ 21	,,	14,349	— 926	8·5	..
Mid. Joint Com'tee	,, 22	12,065	+ 618	,,	241,276	— 1,408	..	..
Oldham—Ashton	,, 22	1,178	+ 62	,,	23,792	— 1,247	9·18	..
Peterborough	,, 22	288	— 12	,,	5,086	— 428	5·31	..
Potteries	,, 22	3,952	+ 249	,,	75,394	— 626	29	..
Rothesay	,, 22	102	— 29	,,	6,919	+ 148	2·75	..
Southport	,, 22	514	— 14	,,	12,476	— 355	8·17	..
S. Metropolitan	,, 22	1,651	— 39	,,	34,105	— 573	..	..
Swansea	,, 22	2,017	+ 96	,,	41,241	+ 1,200	12·5	..
Tynemouth	,, 22	397	+ 52	,,	10,785	+ 976	3·75	..
Weston-s-Mare	,, 22	109	— 5	,,	6,917	+ 388	3	..
†Worcester	,, 22	530	+ 2	,,	11,949	— 161	5·75	..
Wrexham	,, 22	188	— 19	,,	4,191	— 172	..	..
Yorks. Wool. Dist.	,, 22	2,054	+ 184	,,	38,875	+ 84	17	..
Miscellaneous	,, 22	428	+ 40	,,	8,934	+ 175	..	..
Burnley	,, 30	2,437	+ 245	..	..	..	..	..
Burton-on-Trent	,, 31	510	— 20	31	8,366	— 214	6·63	..
Bury	,, 31	2,219	+ 87	30½	35,839	— 384	22·5	..
Cardiff	,, 28	4,318	+ 276	30	67,340	+ 945	..	..
Carlisle	,, 30	315	— 12	43	7,234	— 340	..	..
Chatham and Dist.	,, 28	1,557	+ 50	43	35,828	+ 1,622	14·98	..
Cork	,, 28	947	+ 24	43	19,550	— 520	9·89	..
†Croydon	,, 8	1,793	+ 241	..	43,964	+ 2,916	11·25	4·75
Darlington	,, —	372	— 31	31	5,779	— 421	..	..
Darwen	,, 29	495	+ 19	30	7,685	— 187	4·36	..
Dover	,, 23	402	+ 24	30	5,798	— 403	4·75	..
Dublin	,, 29	10,384	+ 306	..	99,801	+ 1,930	54·25	..
Dundee	,, 27	2,387	+ 81	29½	28,590	— 508	15	..
East Ham	,, 30	1,937	+ 160	30½	31,454	+ 4,219	8·52	·77
Exeter	.. ..	..	..	..	..	..	..	..
Glasgow	,, 30	34,576	— 196	..	871,105	— 5,223	94½	5
Hastings	,, 28	1,659	— 43	..	..	..	..	..
Huddersfield	.. ..	..	..	..	..	..	..	..
Hull	.. ..	..	..	..	..	..	..	..
Ilkeston	,, 27	314	+ 6	30	4,208	— 237	..	..
Ipswich	,, 30	716	+ 27	31	13,087	+ 142	10·5	..
†Kilmarnock	,, 28	150	+ 9	23	3,501	— 108	4·25	..
Lan'kshire Trm.Co.	.. ..	..	..	..	..	..	..	..
Lancashire United	,, 27	2,473	— 1	43	57,280	— 763	30	..
Leeds	,, 28	14,075	+1,290	30	205,054	+ 5,297	54	6
Leicester	,, 30	4,461	+ 250	..	..	..	..	..
Leith	,, 28	1,188	+ 182	23	14,763	+ 1,916	9	3
†Liverpool	,, 23	10,997	+ 317	42⅜	455,084	— 1,764	58 5	..
‡L.C.C.	,, 16	78,974	+3,630	..	1,053,003	+33,782	124·7	2 375
London United	,, 30	11,147	— 938	..	365,318	—28,365	..	..
Lowestoft	,, 30	365	+ 18	5	814	— 5	3·5	..
Manchester	,, 30	29,291	—2,242	31	484,495	— 6,978	105	..
Newcastle	,, 30	8,164	+ 18	..	119,704	— 1,897	..	..
Newport	,, 23	1,317	+ 64	30	20,027	— 248	14·5	..
Oldham	,, 31	3,426	— 43	31	58,927	— 3,828	28·75	..
Pontypridd	,, 30	799	+ 27	30½	12,816	+ 1,011	5·5	1·75
Portsmouth	,, 30	3,666	+ 354	31	68,400	+ 2,147	14·5	·75
Preston	,, 27	1,463	+ 85	..	..	..	..	..
Rotherham	,, 31	1,169	— 35	30	17,937	— 882	10	·66
Salford	,, 25	8,965	— 78	29½	133,598	— 4,009	..	..
Sheffield	,, 31	11,414	+ 139	31½	177,682	+ 880	30·62	2·6
Southampton	,, 27	2,130	+ 133	30	33,449	— 283	..	..
Southend-on-Sea	,, 27	695	+ 108	30	17,832	+ 2,458	..	..
South Shields	,, 30	1,077	+ 21	30½	17,645	— 54	..	..
†Swindon	.. ..	..	..	..	..	..	..	..
Tyneside	,, 27	965	+ 57	17	7,798	+ 981	..	..
Wallasey	,, 30	1,703	+ 30	30½	29,845	+ 780	..	·22
†Walthamstow	,, 23	620	+ 49	30	20,516	+ 919	9	..
West Ham	,, 21	4,718	+ 306	29	69,674	+ 4,284	15·13	·43
Wolverhampton	,, 27	1,858	+ 279	30	25,386	— 294	14·26	1·75
Baker St.-Waterloo	,, 30	6,015	+ 25	17	51,525	+ 235	4·25	..
Cen. London Rly.	,, 30	11,322	— 5,624	17	87,051	—42,896	6·32	·55
Char. +, Eus. Hamp.	,, 30	7,745	+ 640	17	62,685	+ 6,355	7·75	..
City & S. Lon. Rly.	,, 31	6 558	+ 80	17	52,611	+ 1,578	7·3	..
Dublin-Lucan Rly.	,, 29	340	— 9	17	2,690	+ 75	7	..
G.N. and City Rly.	,, 30	2,846	+ 9	17	22,070	+ 12	3.5	..
G.N., P'y. & Brmin.	,, 30	11,760	+ 630	17	87,345	+ 1,750	9·25	..
L'pool Overh'd Rly.	,, 31	2 733	+ 59	17	25,559	+ 80	6·8	4·3
Llandudno-Col. Bay	,, 29	303	+ 33	48	13,744	+ 2,182	..	..
Mersey Railway	,, 30	3 868	+ 121	17	32,816	+ 1,224	4·5	..
Metropolitan Rly.	,, 30	32.490	—1,378	..	270.805	— 6,526	24·5	..
Met. District Rly.	,, 30	20,852	+ 596	17	163,705	+ 6,327	24	..
Anglo-Argentine	,, 28	82,180	+6,353	..	1,087,240	+104,415	..	..
§Auckland	,, 8	13,794	+1,430	..	136,501	+ 12,450	22·3	1·38
Bombay (B.E.T.)	Sept. 30	4,852	— 82	45	97,671	+ 5,408	..	..
§Brisbane	,,	15,800	+1,310	..	..	..	..	..
§Brit. Columbia Rly.	.. ..	..	..	..	..	..	..	..
Calcutta	Oct. 30	6,477	+ 489	..	..	..	..	..
§Cape Electric T. Ld.	.. ..	..	..	..	..	..	..	..
§Kalgoorlie, W.A.	Sept.	4,269	..	..	34,534	..	20·5	..
Madras	Oct. 31	1,403	+ 180	..	25,714	+ 936	..	..
§Melbourne	.. ..	..	..	..	..	..	..	..
§Lisbon	.. ..	..	..	..	..	..	..	..
Perth (W.A.)	,, 29	2,735	— 112	..	60,146	+ 575	28	2·4

* Compared with the corresponding period of 1908. † One week only.
‡ Includes horse, steam and other receipts. § One month.

STOCKS AND SHARES.

Tuesday Afternoon.

The swing of the pendulum has been in the direction of greater confidence, with the result that prices generally have recovered from some of their worst weakness on the money scare. Only in Consols and similar gilt-edged securities is improvement retarded. Even Home Rails show a better tendency.

Amongst the electricity departments, the movement displays itself mostly in a smart rally in Anglo-American Telegraph Deferred stock, where the gamble on the prospects of next February's dividend is resumed with vigour. The Canadian-Mexican group was comparatively little affected in the earlier slump, so prices have varied only narrowly.

Electrical railway stocks are motionless, neither Metropolitans nor Districts recovering from their falls. There is likely to be a good deal of opposition to the District Railway's scheme for reorganising the Guaranteed and Preference interest, and although it is probable that the directors will be able to command more than sufficient stock to carry their scheme, the dissentients are marshalling forces in some strength. Underground Electric 6 per cent. income bonds have fallen 3, and the other two issues continue a dull market.

London United Trams have gained ½. Brush issues are unaltered. Further inquiry for British Westinghouse 4 per cent. Debenture stock raised the price a couple of points. Cape Electric Trams keep nominally about 6s. 3d., although the report just out is a miserable document. No dividend, of course, is paid; there has not been one on the Ordinary shares since July, 1905. The carry-forward of a credit balance of £5,900 is about £2,500 less than the same item a year ago. Certainly, the company appears to get more than its fair share of bad luck, but with South Africa reviving so refreshingly, it might have been supposed that important tramways at Cape Town and Port Elizabeth would have done better.

Victoria Falls Power Preference shares are better at a trifle under £1, another rise in Chartered supplying the motive power for their improvement. The London electricity companies' issues are quiet as usual. Westminster Ordinary are ⅛ lower, and this is the only alteration. Mexican Light and Power, and Canadian General descriptions are steady. Electrical Development of Ontario 5 per cent. Gold Bonds were done at 81¾ the other day. Kalgoorlie Preference were sold at 15s. 6d. There are a few *ex* dividend markings in this section, but they have led to no changes of consequence.

Babcock & Wilcox shares were bid for most energetically at 4½, although the Official List quotation is left with the price as the middle. Industrials once more are favoured, and business in the leading issues is fairly active. Rubbers are to the fore again, thanks to a fresh rise in the price of the product, and the stream of new companies threatens to set in with renewed force. India-Rubber, Gutta-Percha shares have gone up ¼, the shares being scarce.

With the restoration of a better tone to the stock markets, Anglo-American Telegraph deferred experienced a rapid recovery, and, as already noted, optimistic expectations of the next dividend are in great vogue at present. Direct United States Cable shares keep dull. Great Northerns are 10s. better, and the fall of 10s. in Indo-Europeans is more than accounted for by the deduction of the dividend of 12s. 6d. a share. The Eastern and Eastern Extension reports had no effect upon prices.

New York Telephone Debenture at 2½ premium is the turn lower, although American Telegraph and Telephone capital stock gained a point. Cuba Telephone rallied to 3 discount, after changing hands at 5 discount. It is understood that underwriters were left with a large proportion. National Telephone Third Preference shares are a trifle easier. Business is rather more active in Marconi's than it has been recently; the price of the shares remains about 16s. 3d. United River Plate Preference are $\frac{1}{16}$ up, while Oriental Telephones at $1\frac{7}{16}$ are still somewhat weak.

Better prices are quoted for Mexico Trams Common stock, and 5 per cent. bonds, and for Rio Trams at 90. The Argentine division is quietly firm, the company's Debenture stocks, both 4 per cent. and 4½ per cent., being steadily absorbed for investment.

Aluminium Corporation, Ltd.—The Court has directed separate meetings of the unsecured creditors and the holders of the preference and ordinary shares respectively to be held on November 11th at Winchester House, E.C., to consider a scheme of arrangement between the company and its creditors.

SHARE LIST OF ELECTRICAL COMPANIES.

TELEGRAPH AND TELEPHONE COMPANIES.

Present Issue.	NAME.	Stock or Share.	Dividends for the last four years. 1906.	1906.	1907.	1908.	Closing Quotations Oct. 26th.	Closing Quotations Nov. 2nd.	Business done week ended Nov. 2nd, 1909. Highest	Lowest.	Rise + or Fall —	Present Yield per cent. £ s. d.
25,000	Amazon Telegraph Co.'s shares, Nos. 1 to 25,000	£5	Nil	Nil	Nil	Nil	3 — 3¼	3 — 3¼	..	..	..	Nil.
136,700	Do. do. 5 % Debs., Nos. 1 to 1,350 Red.	£100	5 %	5 %	5 %	5 %	95 — 98	96 — 99	..	..	+1	5 1 0
$121,551,400	American Telephone & Telegraph, Cap. Stock ..	$100	7½%	8 %	8 %	8 %	143 —145	144 —146	..	..	+1	5 9 7
$53,000,000	Do. Collat. Trust, 4% Bonds, 1 to 28,000 and 53,001 to 78,000	$1000	4 %	4 %	4 %	4 %	96 — 98	96 — 93	..	..	..	4 1 8
558,460	Anglo-American Telegraph	Stock	3½%	3½%	3½%	23 4s.	61 — 63	61 — 63	..	..	..	5 3 2
3,220,770	Do. do. do. 5 % Pref.	Stock	6 %	6 %	6 %	6 %	102 —103	101⅝—102⅝	102⅝	101½	— ⅛	5 16 10
3,220,770	Do. do. do. Deferred	Stock	1½%	1½%	1 %	8/-	21⅜— 21⅝	21⅜— 21⅝	21⅞	21¼	+2⅛	1 16 8
47,725	Anglo-Portuguese Tel., 5 % Mort. Deb. Stock Red.	£100	5 %	5 %	5 %	5 %	101 —103	101 —103	..	..	..	4 17 1
44,000	Chili Telephone, Nos. 1 to 44,000	£5	8 %	8 %	8 %	8 %	8 — 8⅛	8 — 8⅛	7⅞	..	..	4 14 1
2,431,350	Commercial Cable, Sting. 500 year 4% Deb. Stk. Red.	Stock	4 %	4 %	4 %	4 %	87 — 89	87½— 89½	88½	..	+ ½	4 9 5
16,000	Cuba Telegraph	£10	5 %	5 %	6 %	6 %	8⅝— 9⅜	8⅝— 9⅜	..	..	— ⅛	6 9 9
6,000	Do. 10 % Pref.	£10	10 %	10 %	10 %	10 %	17½— 18½	17 — 18	..	..	— ½	5 11 1
12,981	Direct Spanish Telegraph, Ord.	£5	4 %	4 %	4 %	4 %	3 — 3½	3 — 3½	..	..	..	5 14 8
6,000	Do. do. 10 % Cum. Pref.	£5	10 %	10 %	10 %	10 %	8 — 8½	8 — 8½	..	..	..	6 5 0
80,000	Do. do. 4½ % Debs.	£20	4½%	4½%	4½%	4½%	100½—102½	100½—102½	..	..	..	2 3 11
60,710	Direct United States Cable	£20	4½%	4½%	4½%	4½%	13 — 15½	13 — 15½	15⅝	13⅛	..	6 4 7
48,500	Direct W. India Cable, 4½ % Reg. Deb., 1 to 1,200, R.	£100	4½%	4½%	4½%	4½%	100 —102	100 —102	..	..	..	4 8 3
4,000,000	Eastern Telegraph, Ord. Stock..	Stock	7 %	7 %	7 %	7 %	126 —129	126 —129	127½	126	..	5 8 6
2,000,000	Do. 5½ % Pref. Stock..	£100	5½%	5½%	5½%	5½%	83½— 85½	83½— 85½	84⅛	84⅜	..	4 1 10
1,996,706	Do. 4 % Mort. Deb. Stock. Red. ..	Stock	4 %	4 %	4 %	4 %	104½—106½	102½—104½	..	..	—2	3 16 7
900,000	Eastern Extension, Australasia, and China Tele	£10	7 %	7 %	7 %	7 %	11⅝— 12⅝	11⅝— 12⅝	12	..	..	5 14 3
753,400	Do. 4 % Deb. Stock	Stock	4 %	4 %	4 %	4 %	102 —104	102 —104	..	..	..	3 16 11
200,000	East. & S. Afric. Tel., 4 % Mt Db. Mauritius Sub.) 1 to 3,000	£5	4 %	4 %	4 %	4 %	100 —102	100 —102	..	..	..	3 18 5
181,127	Globe Telegraph and Trust	£10	5½%	5½%	5½%	5½%	10½— 10⅝	10½— 10⅝	10⅝	..	..	5 8 3
181,127	Do. do. 6 % Pref...	£10	6 %	6 %	6 %	6 %	13½— 14	13⅝— 14	13⅞	13⅝	..	4 5 9
150,000	Great Northern Telegraph, of Copenhagen.. ..	£10	24%	20 %	20 %	18 %	28 — 29	28½— 29½	28⅝	..	+ ⅛	7 0 0
10,000	Halifax and Bermudas Cable, 4½ % 1st Mort. Debs., within Nos. 1 to 1,200, Red.	£100	4½%	4½%	4½%	4½%	100 —102	100 —102	..	..	..	4 8 8
17,000	Indo-European Telegraph	£5	13 %	13 %	13 %	13 %	51½— 53½	51 — 53	..	..	— ½	7 1 2
$41,380,400	Mackay Companies Common	$100	2 %	3½%	4 %	4 %	93 — 95	93½— 95	..	..	..	4 4 3
$50,000,000	Do. do. 4% Cum. Pref.	$100	4 %	4 %	4 %	4 %	77 — 79	77 — 79	..	..	..	5 1 8
894,190	Marconi's Wireless Telegraph	£1	Nil	Nil	Nil	Nil	⅞— ⅞	⅞— ⅞	17/6	..	..	N l
72,680	Monte Video Telephone Co., Ltd. Ord.	£1	5 %	6 %	6 %	6 %	⅞— 1	⅞— 1	..	..	..	6 8 0
86,492	Do. do. do. 5 % Pref.	£1	5 %	5 %	5 %	5 %	⅞— 1	⅞— 1	..	..	..	5 6 8
2,225,000	National Telephone, Pref. Stock	£100	6 %	6 %	6 %	6 %	107 —108½	107 — 108½	107½	..	..	5 10 7
3,725,000	Do. do. Def. Stock	£100	5 %	5 %	6 %	6 %	120 —122	120 —122	121	120	..	4 18 4
15,000	Do. do. 6 % Cum. 1st. Pref.	£10	6 %	6 %	6 %	6 %	10½— 11	10½— 11	..	..	..	5 9 1
15,000	Do. do. 6 % Cum. 2nd Pref.	£10	6 %	5 %	6 %	6 %	10½— 10⅞	10½— 10⅞	..	..	..	5 10 4
250,000	Do. do. 5 % Non-cum. 3rd P., 1 to 250,000	£5	5 %	5 %	5 %	5 %	5⅛— 5⅛	5⅛— 5⅛	5⅛	..	— ⅛	4 8 11
2,000,000	Do. do. 5½ % Deb. Stock Red. ..	Stock	5½%	5½%	5½%	5½%	98 —100	98 —100	..	..	..	5 10 0
1,988,598	Do. do. 4 % Deb. Stock Red.	£100	4 %	4 %	4 %	4 %	100 —102	100 —102	..	..	..	3 18 5
179,318	Oriental Telep. and Elec. 1 to 171,504, fully paid ..	£1	7 %	7 %	8 %	8 %	1⅜— 1⅝	1⅜— 1⅝	..	..	..	5 5 9
50,000	Do. do. do. 6 % Cum. Pref... ..	£1	6 %	6 %	6 %	6 %	1⅜— 1⅝	1⅜— 1⅝	..	..	..	4 14 9
99,100	Do. do. do. 4 % Red. Deb. Stock ..	£100	4 %	4 %	4 %	4 %	86½— 88½	86½— 88½	..	..	..	4 10 5
99,400	Pacific & European Tel., 4 % Guar. Debs., 1 to 1,000	£10	4 %	4 %	4 %	4 %	100 —102	100 —102	..	..	..	3 18 5
11,889	Reuter's	£8	5 %	5 %	5 %	5 %	7⅝— 8⅛	7⅝— 8⅛	..	..	..	4 18 9
145,955	Telephone Co. of Egypt, 4½ % Deb. Red.	£100	4½%	4½%	4½%	4½%	100½—102½	100½—102½	..	..	..	4 7 10
3,042	Submarine Cables Trust	Certs.	6 %	6 %	6 %	6 %	129 —132	129 —132	..	..	..	4 10 11
120,000	United River Plate Telephone	£5	8 %	8 %	8 %	8 %	6⅞— 7⅛	6⅞— 7⅛	7⅛	..	..	5 10 4
40,000	Do. 5 % Cum. Pref., Nos. 1 to 40,000	£5	5 %	5 %	5 %	5 %	5⅜— 5⅝	5⅞— 6⅛	..	..	+ ⅛	4 8 4
80,008	W. Coast of America, 1 to 80,000 & 55,001 to 58,008	2½	Nil	2½%	2½%	2½%	1⅜— 1⅝	1⅜— 1⅝	..	..	..	3 16 4
160,000	Do. 4 % Debs., 1 to 1,600 guar. by Bras. Sub. Tel.	£100	4 %	4 %	4 %	4 %	100 —102	100 —102	..	..	..	3 18 5
207,980	Western Telegraph, Ltd., Nos. 1 to 207,980.. ..	£10	7 %	7 %	7 %	7 %	18½— 14	18⅜— 14	18⅝	18⅜	..	5 0 0
800,000	Do. do. 4 % Deb. Stock Red. ..	£100	4 %	4 %	4 %	4 %	103 —105	103 —105	..	..	..	3 16
88,321	West India and Panama Telegraph	£10	Nil	Nil	Nil	Nil	⅛— ⅜	⅛— ⅜	..	..	..	Nil
84,563	Do. do. 6 % Cum. 1st Pref.	£10	5 %	3 %	6 %	6 %	8½— 9½	8½— 9½	8⅞	..	..	6 9 9
4,669	Do. do. 6 % Cum. 2nd Pref.	£10	Nil	Nil	£2 6	15 %	8½— 9¼	8½— 9¼	8⅝	..	..	15 15 10
80,000	Do. do. 5 % Debs., Nos. 1 to 1,800	£100	5 %	5 %	5 %	5 %	101½—103½	101½—103½	..	..	..	4 16 7

ELECTRICAL RAILWAY, MANUFACTURING AND INDUSTRIAL COMPANIES.

640,000	Anglo-Argentine Trams, 5 % Cum. 1st Pref., 1 to 640,000	£5	..	..	..	..	4⅜— 4⅝	4½— 4⅝	95/-	90/7½	— ⅛	5 2 4
500,000	Do. 5 % 2nd Pref., 500,001 to 1,000,000	£5	..	..	..	..	4¼— 4½	4¼— 4½	87/6	85/-	..	5 6
978,230	Do. 4 % Deb. Stock	..	..	..	..	4 %	91 — 92½	91 —92½	91½	91	..	4 6 6
382,387	Auckland E. Trams, 5 % 1st Mort. Deb. Stock ..	£100	5 %	5 %	5 %	5 %	102 —105	102 —105	..	..	..	4 15 3
580,000	Babcock & Wilcox, 1 to 580,000..	£1	20 %	20 %	20 %	20 %	4⅞— 4⅞	4⅞— 4⅞	91/8	90/6	+ 1/16	4 6 6
100,000	Do. do. 6 % Cum. Pref., 1 to 100,000 ..	£1	6 %	6 %	6 %	6 %	1⅛— 1⅛	1⅛— 1⅛	..	..	..	3 19 2
60,000	British Aluminium, Ord., 1 to 40,000	£5	7 %	7 %	7 %	7 %	1⅜— 1⅝	1⅜— 1⅝	..	..	+ ⅛	37 6 8
60,000	Do. do. 7 % Cum. Pref.	£5	7 %	7 %	7 %	7 %	1⅜— 2⅛	1⅜— 2⅛	40/-	..	..	15 1 4
40,100	Do. do. "A" 6 % Cum. Pref.	£5	6 %	6 %	6 %	6 %	3½— 3⅝	3½— 3⅝	..	..	..	7 10 11
12,897	Do. do. 4 % Funding Certs.	£5	4 %	4 %	4 %	4 %	2½— 3⅛	2½— 3⅛	..	..	..	5 14 8
124,400	Do. do. 5½ % Loch Leven Debs. ..	£100	..	5½%	5½%	5½%	96 — 99	96 — 99	..	..	..	5 14 7
600,000	British Columbia E. Rail Def. Ord. Stock	£100	6 %	6 %	8 %	8 %	150 —155	150 —155	..	..	..	5 3 5
400,000	Do. Pref. Ord. Stock	£100	5 %	5 %	5 %	6 %	123 —128	123 —128	125	124½	..	4 18 9
400,000	Do. 5 % Cum. Perp. Pref. Stock	£100	5 %	5 %	5 %	5 %	109 —112	109 —112	111	..	..	4 9 3
283,000	Do. 4½ % 1st Mort. Debs., 1 to 6,250	£40	4½%	4½%	4½%	4½%	100 —102	100 —102	103½	..	..	4 8 3
212,600	Do. 4½ % Vancouver Power Debs., 1 to 2,300	£100	4½%	4½%	4½%	4½%	102 —105	102 —105	..	..	..	4 5 9
133,801	British Electric Traction	£10	3 %	Nil	Nil	Nil	⅝— 1	⅝— 1	15/3	..	..	Nil
161,487	Do. do. 6 % Cum. Pref.	£10	6 %	6 %	3 %	1½%	2⅜— 2⅝	2⅜— 2⅝	£0/3	46/3	..	6 0 0
1,478,658	Do. do. 5 % Perp. Deb. Stock ..	Stock	5 %	5 %	5 %	5 %	83½— 85½	83½— 85½	84½	83	..	5 9 1
528,986	Do. do. 4½ % 2nd Deb. Stock Red.	£100	4½%	4½%	4½%	4½%	60 — 64	58 — 62	60½	58	—2	7 5 2
100,000	British Insulated and Helsby Cables	£5	8 %	10 %	10 %	10 %	7⅞— 7⅞	7⅞— 7⅞	7⅞	7⅞	..	7 0 8
100,000	Do. do. 6 % Cum. Pref.	£5	6 %	6 %	6 %	6 %	6⅝— 6⅞	6⅝— 6⅞	6⅞	..	..	4 11 8
500,000	Do. do. 4½ % 1st Mort. Deb. Red.. ..	£100	4½%	4½%	4½%	4½%	103 —106	103 —106	..	..	..	4 4 11
304,940	British Thomson-Houston 4½ % 1st Mort. Debs. ..	£100	4½%	4½%	4½%	4½%	89 — 94	89 — 94	..	..	..	4 15 9
400,000	British Westinghouse 6 % Pref., 1 to 300,000 and 375,001 to 475,000	£5	Nil	Nil	Nil	Nil	⅛— ⅜	⅛— ⅜	..	..	..	Nil
1,416,358	Do. do. 4 % Mort. Deb. Stock ..	£100	4 %	4 %	4 %	4 %	42 — 44	44 — 47	..	..	+2½	8 10 2
50,000	Browett, Lindley & Co., Ord.	£1	Nil	Nil	Nil	Nil	⅞— 1⅛	⅞— 1⅛	..	..	..	Nil
50,000	Do. do. 6 % Cum. Pref.	£1	Nil	Nil	Nil	Nil	14/6 to 15/6	14/6 to 15/6	..	..	..	Nil
140,976	Brush Electrical Engineering, Ord., 1 to 105,781 ..	£2	2½%	Nil	Nil	Nil	0 — ⅛	0 — ⅛	..	..	..	Nil
200,000	Do. do. Non-cum. 6 % Pref.	£2	6 %	Nil	Nil	Nil	0 — ⅛	0 — ⅛	..	..	..	Nil
125,000	Do. do. 4½ % Perp. Deb. Stock ..	Stock	4½%	4½%	4½%	4½%	41 — 46	41 — 46	..	..	..	9 15 8
125,000	Do. do. 4½ % Perp. 2nd Deb. Stock..	Stock	4½%	4½%	4½%	4½%	27 — 31	27 — 31	..	..	..	14 10 2
127,610	Calcutta Trams, 1 to 127,610	£5	8 %	8 %	6 %	4½%	4½ — 5	4½ — 5	97/6	92/½	..	4 10 0
45,304	Do. 5 % Cum. Pref., Nos. 1 to 29,520..	£5	5 %	5 %	5 %	5 %	4½ — 5	4½ — 5	..	..	..	5 0 0
950,000	Do. 4½ % 1st Deb. Stock..	£100	4½%	4½%	4½%	4½%	101 —104	101 —104	..	..	..	4 6 7
35,000	Callender's Cable Construction shares	£5	15 %	15 %	15 %	15 %	10⅜— 11⅛	10⅜— 10⅝	10⅝	10⅜	— ⅛	6 18 0
40,000	Do. do. 5 % Cum. Pref.	£5	5 %	5 %	5 %	5 %	5⅜— 5⅝	5⅜— 5½	..	..	..	4 6 11
800,000	Do. do. 4½ % 1st Mort. Deb. Stock Red.	Stock	4½%	4½%	4½%	4½%	105—107	105 —107	..	..	..	4 4 1
491,292	Cape E. Trams., 1 to 491,292	£1	Nil	Nil	Nil	Nil	⅞— 1⅛	⅞— 1⅛	..	..	..	Nil
450,000	Castner-Kellner Alkali, 1 to 450,000	£1	6 %	8 %	12 %	12½%	2⅛— 2⅜	2⅛— 2⅜	..	..	..	5 10 1
210,158	Do. do. 4½ % 1st Mort. Deb. Stock	100	4½%	4½%	4½%	4 %	106 —109	106 —109	..	..	..	3 13 5
1,990 690	Central London Railway, Ord. Stock..	Stock	4 %	4 %	3 %	3½%	60 — 62	60 — 62	61¾	60¼	..	5 4 10
554,655	Do. do. 4 % Pref. Stock	Stock	4 %	4 %	4 %	4 %	85 — 87	85 — 87	86½	..	..	4 14 2
554,655	Do. do. Def. do.	Stock	4 %	4 %	2 %	2½%	43 — 45	43 — 45	44¾	..	..	5 11 1
1,480,000	City and South London Railway	Stock	12½	2½%	2½%	1½%	30 — 31	30 — 31	30½	30	..	4 16 9
85,000	Crompton & Co., Nos. 1 to 85,000	£5	5½%	5 %	5 %	5 %	⅛— 1	⅛— 1	..	..	..	15 1 8
100,000	Do. 5 % 1st Mort. Reg. Debs., 1 to 900 of £100, and 901 to 11,200 of £50 Red.	..	5 %	5 %	5 %	5 %	90 — 93	90 — 93	..	..	..	5 7 6

* Unless otherwise stated, all shares are fully paid. † A period of nine months. From Manchester Share List.

Continued on next page.

SHARE LIST OF ELECTRICAL COMPANIES.—(*Continued.*)

ELECTRICAL RAILWAY, MANUFACTURING AND INDUSTRIAL COMPANIES.—(*Continued.*)

Present Issue.	NAME.	Stock or Share.	Dividends for the last four years. 1905.	1906.	1907.	1908.	Closing Quotations Oct. 26th.	Closing Quotations Nov. 2nd.	Business done week ended Nov. 2nd, 1909. Highest	Lowest	Rise + or Fall −	Present Yield per cent. £ s. d.
260,000	Dick, Kerr & Co., 1 to 260,000	* 1	10 %	10 %	10 %	10 %	1 — 1⅛	1 — 1⅛	..	..	..	8 17 9
305,000	Do. do. 6 % Cum. Pref., 1 to 305,000	1	6 %	6 %	6 %	6 %	1 — 1⅛	1 — 1⅛	..	..	..	5 6 8
271,030	Do. do. 4½ % Deb. Stock	100	4½%	4½%	4½%	4½%	100 —103	100 —103	..	..	..	4 7 5
60,000	Dublin United Trams. (1896), 6 % Pref., 1 to 60,000	10	6 %	6 %	6 %	6 %	12⅜ — 13⅜	12⅜ — 13⅜	..	..	..	4 7 8
99,261	Edison & Swan Utd., "A" shs., £8 pd., 1 to 99,261	5	4⅜%	4⅜%	2½%	1½%	⅜ — ⅝	⅜ — ⅝	2/6	..	..	27 5 4
17,189	Do. "A" shares, 01—017,189	5	4⅜%	4⅜%	2½%	2½%	1 — 1½	1 — 1½	..	..	..	8 6 8
307,895	Do. 4 % Deb. Stock Red.	100	4 %	4 %	4 %	4 %	68 — 73	68 — 73	..	..	..	5 9 7
67,720	Do. 5 % 2nd Deb. Stock Prov. Certs. all pd.	100	5 %	5 %	5 %	5 %	82 — 85	82 — 85	..	..	..	5 12 4
112,100	Electric Construction, 1 to 112,100	2	Nil	Nil	Nil	Nil	⅞ — 1	⅞ — 1	..	..	..	Nil
31,890	Do. do. 7 % Cum. Pref., 1 to 31,890	2	7 %	7 %	7 %	7 %	1⅞ — 1⅞	1⅞ — 1⅞	..	..	..	9 18 1
25,000	General Electric Co. (1900), 5 % Cum. Pref.	10	5 %	5 %	5 %	5 %	8½ — 8⅝	8½ — 8⅝	..	..	..	5 14 3
200,000	Do. do 4 % Mort Deb.	Stock	4 %	4 %	4 %	4 %	83 — 87	83 — 87	..	..	..	4 12 0
78,000	Gt. N. & City Rail. Pref. Ord. "A" 4 %, 1 to 78,000	10	4 %	4 %	¾	Nil	⅞ — 1	⅞ — 1	..	..	..	6 13 4
96,000	Greenwood & Batley, 7 % Cum. Pref.	10	7 %	7 %	7 %	..	10½ — 10⅝	10½ — 10⅝	..	..	..	6 10 8
80,000	Do. do. 5 % Mort. Debs.	100	5 %	5 %	5 %	5 %	102 —103	102 —103⅛	..	..	..	4 16 10
40,000	Henley's (W. T.), Telegraph Works, Ord.	5	15%	15 %	15%	15 %	12½ — 13½	12½ — 13½	12⅞	..	..	5 12 2
40,000	Do. do. 4½ % Pref.	5	4½%	4½%	4½%	4½%	5⅜ — 5½	5⅜ — 5½	..	..	..	4 1 10
150,000	Do. do. 4½ % Mort. Deb. Stock	Stock	4½%	4½%	4½%	4½%	106 —108	106 —108	..	..	..	4 3 4
50,000	India-Rubber, Gutta-percha & Telegraph Works..	10	10%	10 %	10 %	10 %	15 — 15⅞	15⅛ — 16	..	..	+ ⅛	6 5 0
37,500	†Liverpool Overhead Railway, Ord.	10	Nil	Nil	½%	Nil	⅜ — ⅝	⅜ — ⅝	..	..	..	Nil
10,000	† Do. do. Pref., fully paid	10	5 %	5 %	5 %	5 %	4½ — 5	4½ — 5	..	..	..	10 0 0
600,070	London United Trams. (1901), 1 to 50,007	10	3 %	3 %	3 %	Nil	1⅜ — 2⅛	1⅜ — 2⅛	..	..	..	Nil
899,930	Do. do. 50,008 to 100,000	10	3 %	3 %	3 %	Nil	1⅜ — 2⅛	1⅜ — 2⅛	..	..	..	Nil
125,000	Do. do. 5 % Cum. Pref., 1 to 125,000	10	5 %	5 %	5 %	3⅔%	2⅛ — 2⅜	2⅛ — 2⅜	..	..	+ ⅛	13 0 10
1,331,000	Do. do. 4 % 1st Mort. Deb. Stock	100	4 %	4 %	4 %	4 %	67 — 70	67 — 70	68⅞	..	..	5 14 4
5,782,062	Metropolitan Consolidated	100	2⅜%	1 ¾%	¾%	¾%	37½ — 37⅞	37½ — 37⅞	37⅞	37½	..	1 6 6
2,540,914	Do. Surplus Lands	100	2⅜%	2⅜%	2¼%	2¼%	64 — 66	64 — 65	64⅞	..	..	4 3 4
8,285,000	Do. District	100	Nil	Nil	Nil	Nil	16 — 16½	16 — 16½	16⅛	..	..	Nil
891,337	Metropolitan Electric Trams., Ord.	1	..	..	..	4½%	⅛ — ⅛	⅛ — ⅛	..	..	..	6 10 11
314,016	Do. do. Defd.	1	Nil	Nil	Nil	Nil	⅛ — ⅛	⅛ — ⅛	..	..	..	Nil
500,000	Do. do. 5 % Cum. Pref.	1	5 %	5 %	5 %	5 %	⅜ — ⅜	⅜ — ⅜	..	..	— 1/32	6 3 1
595,600	Do. do. 4½ % Deb. Stock Red.	100	4½%	4½%	4½%	4½%	94½ — 96½	93¾ — 96½	94½	..	+ ½	4 13 3
10,823,200	Mexico Trams Co., Common Stock	..	..	..	..	..	126 —129	124½ —127½	127	125½	—1½	..
$9,000,000	Do. 1st Mort. 50-year 5% Gld. Bds.	..	..	..	..	5 %	91 — 93	91 — 93	92½	91½	..	5 7 6
245,500	Potteries Electric Traction	1	4 %	4 %	4 %	Nil	⅛ — ¼	⅛ — ¼	..	..	..	..
245,500	Do. 5 % Cum. Pref.	1	5 %	5 %	5 %	5 %	⅛ — ¼	⅛ — ¼	..	..	..	6 17 11
245,000	Do. 4½ % Deb. Stock	100	4½%	4½%	4½%	4½%	86 — 89	86 — 89	..	..	..	5 1 2
87,850	Telegraph Construction and Maintenance	12	15 %	15 %	17½%	15 %	34½ — 36	34½ — 36	35⅝	34⅞	..	5 0 0
140,000£	Do. 4 % Deb. Bds., 1 to 1,500 Red., 1909	100	4 %	4 %	4 %	4 %	101 —103	101 —103	..	..	..	3 17 8
1,000,000	Underground Electric Railway, 5% Prior Lien	..	..	..	..	5 %	102½ —103½	100 —101	..	..	—2½	4 19 0
2,800,000	Do. do. 4½% Bonds	..	..	..	..	4½%	86 — 88	86 — 88	87	..	..	5 2 3
4,900,000	Do. do. 6% Income Bonds	..	..	..	..	..	32 — 34	29 — 31	30½	..	—3	..
66,666	Willans & Robinson, 1 to 80,000 & 80,001 to 116,666	5	Nil	Nil	10 %	Nil	⅜ — ⅝	⅜ — ⅝	..	..	..	..
66,666	Do. 6 % C.P., 80,001 to 80,000 & 126,001 to 141,666	1	Nil	..	6 %	6 %	2 — 2½	2 — 2½	..	..	..	2 8 0
245,495	Do. % 1st Mort. Deb. Stock		4 %	4 %	4 %	4 %	76 — 80	76 — 80	..	..	..	5 0 0

ELECTRICITY SUPPLY COMPANIES.

15,000	Bromley (Kent) E.L. & P., 1 to 15,000		5½%	5½%	5½%	5½%	4⅛ — 4	4⅛ — 4⅜	..	..	..	5 2 1
70,000	Do. do. 4½ % 1st. deb. stock	100	4½%	4½%	4½%	4½%	93 — 96	91 — 94 xd	..	..	..	4 13 9
30,449	Brompton & Kens. Elec. Lt. Sup., Ord., 1 to 20,000	5	10 %	10%	10 %	10 %	6½ — 7½	6½ — 7½	..	..	..	6 13 4
9,551	Do. do. 7 % Cum. Pref.	5	7 %	7 %	7 %	7 %	6½ — 7½	6½ — 7½	..	..	..	4 13 4
886,876	Central Electric Supply 4 % Guar. Deb. Stock	100	4 %	4 %	4 %	4 %	97 —100	97 —100	..	..	..	3 18 5
80,000	Charing Cross and Strand Electricity Supply	5	5 %	5 %	5 %	5 %	3⅞ — 4⅛	3⅞ — 4⅛	..	..	..	5 14 3
80,000	Do. do. 4½ % Cum. Pref.	5	4½%	4½%	4½%	4½%	4⅛ — 4	4⅛ — 4⅜	..	..	..	4 12 4
80,000	Do. "City Undertaking" 4½ % Cum. Prf.	5	4½%	4½%	4½%	4½%	3⅞ — 4	3⅞ — 4⅛	..	..	..	5 5 11
445,736	Do. do. 4 % Deb. Stock Red.	100	4 %	4 %	4 %	4 %	98 —101	98 —101	..	..	..	3 19 3
49,496	Chelsea Electricity Supply, Ord.	5	6 %	4½%	4½%	4½%	3½ — 4	3½ — 4	..	..	..	5 12 6
175,000£	Do. do. 4½ % Deb. Stock Red.	Stock	4½%	4½%	4½%	4½%	100 —103	100 —103	101½	..	..	4 7 5
70,595	City of London Elec. Lighting, Ord. 40,001—110,595	10	6 %	6 %	6 %	6 %	10⅜ — 10⅞	10⅜ — 10⅞	10½	..	..	5 10 4
40,000	Do. 6 % Cum. Pref., 1 to 40,000	10	6 %	6 %	6 %	6 %	11⅞ — 12⅛	11⅞ — 12⅛	..	..	..	4 12 4
400,000£	Do. 5 % Db. Stk., Scrip. (iss. at 115) all pd.	..	5 %	5 %	5 %	5 %	121 —124	121 —124	..	..	..	4 0 8
800,000	Do. 4½ % 2nd. Db. Stk., Prov. Crts., all pd.	100	4½%	4½%	4½%	4½%	100 —103	100 —103	101¾	..	..	4 7 5
50,000	County of Durham Electrical Power, Ord.	5	4 %	2 %	..	..	1½ — 2	1½ — 2	..	..	..	5 0 0
50,000	Do. do. do. 5 % Pref.	5	5 %	5 %	5 %	5 %	2⅜ — 3⅜	2⅜ — 3⅜	..	..	..	7 8 2
250,000	Do. do. do. 5 % 1st Mtg. Deb.	Stock	..	..	..	5 %	93½ — 95½	93⅜ — 95½	..	..	..	5 4 9
40,000	County of London Electric Lighting, Ord. 1—40,000	10	5 %	5 %	5 %	5 %	7⅝ — 8⅛	7⅝ — 8⅛	7⅞	7⅜	..	6 1 3
55,000	Do. do. 6 % Pref., 40,001—60,000	10	6 %	6 %	6 %	6 %	10⅝ — 11⅛	10⅝ — 11⅛	10¾	10½	..	5 7 10
400,000£	Do. do. 4½ % Deb. Stock	..	4½%	4½%	4½%	4½%	105 —108	105 —108	..	..	..	4 3 4
400,000	Do. do. 4½ % 2nd. Deb. Stock	Stock	4½%	4½%	4½%	4½%	100 —103	98 —101	..	..	— 2	4 9 1
80,000	Edmundson's Electric Corporation, Ord. Shares	5	4 %	Nil	Nil	Nil	⅛ — ¼	⅛ — ¼	..	..	..	Nil
80,000	Do. do. 5 % Cum. Pref.	5	6 %	3 %	Nil	Nil	⅛ — ¼	⅛ — ¼	..	..	..	Nil
430,500	Do. do. 4½ % 1st Mort. Deb. Stk.	100	4½%	4½%	4½%	4½%	57 — 60	57 — 60	59	..	..	7 10 0
$8,150,000	Electrical Dev. Co. of Ontario, 5% 1st Mtg. Gold Bnds.	$500	..	..	..	5 %	91 — 94	91 — 91	..	..	..	5 6 5
10,000	Folkestone, 1 to 10,000	5	5%	5%	5%	5%	4⅜ — 4⅞	4⅜ — 4⅞	8	..	..	5 12 10
10,000	Do. 5 % Cum. Pref., 1 to 10,000	5	5 %	5 %	5 %	5 %	4⅜ — 5⅛	4⅜ — 5⅛	..	..	..	4 13 0
90,000	Do. 4½ % 1st Deb. Stock	100	4½%	4½%	4½%	4½%	97 —100	97 —100	101	..	..	4 10 0
15,000	Hove, 1 to 15,000	5	9 %	9 %	8⅔%	8⅔%	6⅞ — 7½	6⅞ — 7½	..	..	..	5 17 3
$1,376,000	Kaministiquia Power Co., 5 % Gold Bnds.	..	..	..	..	5 %	99 —101	99 —	100⅜	100⅜	..	4 19 0
21,000	Kensington and Knightsbridge Electric Ord.	5	10 %	10 %	10 %	8 %	7 — 7½	7 — 7½	..	..	..	5 4 1
90,000	Do. do. do. 4 % Deben. Stk.	Stock	4 %	4 %	4 %	4 %	95 — 98	95 — 98	..	..	..	4 4 3
111,000	London Electric Supply Corporation, Limited, Ord.	8	4 %	4 %	2½%	3 %	1⅜ — 2⅛	1⅜ — 2⅛	68/8	..	..	4 16 0
70,000	Do. do. do 6 % Pref.	5	6 %	6 %	6 %	6 %	4⅞ — 5⅛	4⅞ — 5⅛	..	..	..	5 14 3
882,355	Do. do. 4 % 1st Mort. Deb. Stk. Red.	Stock	4 %	4 %	4 %	4 %	93 — 97	93 — 97	..	..	..	4 2 6
200,000	Metropolitan Electric Supply, 1 to 100,000	5	10 %	8 %	6%	5 %	4 — 4⅛	4 — 4⅛	80/7½	..	..	5 11 1
76,121	Do. 4½ % Cum. Pref. 1—71,106	5	4½%	4½%	4½%	4½%	4⅝ — 5	4⅝ — 5	..	..	..	4 10 0
285,000	Do. 4½ % 1st Mort. Deben. Stock	..	4½%	4½%	4½%	4½%	105 —108	105 —108	..	..	..	4 3 4
248,000£	Do. 5% Mort. Deben. Stock Redem.	Stock	5%	5%	5%	5%	83½ — 86½	83½ — 86½	..	..	..	4 0 11
$6,000,000	Mexican Electric Light Co., 5% 1st Mtg. Gold Bnds	..	5 %	5 %	5 %	5 %	80 — 82	80 — 82	82	..	..	6 1 11
18,585,000	Do. Light and Power Co., Ltd., Common	$100	..	..	..	3½%	71 — 75	71 — 75	73	72	..	4 13 4
$3,400,000	Do. do. 7% Cum. Pref. Stk.	Stock	..	..	..	7 %	105 —109	102 —106	105	103	—3	6 12 1
$12,000,000	Do. do. 5% 1st Mtg. Gold Bnds.	..	..	..	..	5 %	85 — 87	85 — 87	86½	85½	..	5 13 8
960,000	Midland Electric Corporation, 4½ % 1st Mort. Deb.	100	4½%	4½%	4½%	4½%	98 —100	98 —100	..	..	..	4 10 0
180,491	Newcastle-on-Tyne, 1 to 137,500	5	8 %	8 %	8 %	2½%	4 — 4⅛	4 — 4⅛	..	..	— ⅛	2 15 1
137,500	Do. 5 % Pref., 1 to 137,500	5	5 %	5 %	5 %	5 %	4⅜ — 5⅛	4 — 4⅛	..	..	— ½	5 10 2
126,500	North Metropolitan Electric Power Supply Co., 5 % Mortgages (Red.), Nos. 1 to 1,265	100	..	..	..	..	99 —101	99 — 101	..	..	..	..
10,852	Notting Hill Electric Lighting	10	7½%	7½%	7½%	7 %	12⅛ — 13⅛	12⅛ — 13⅛	..	..	..	5 6 0
20,000	Oxford, 1 to 96 and 407 to 20,310	5	7 %	7 %	7 %	..	6 — 6½	6 — 6½	..	..	..	5 7 8
60,000	Do. 4 % Deb. Stock	100	4 %	4 %	4 %	4 %	95 — 98	95 — 98	..	..	..	4 1 8
119,694	River Plate Elcty. Co. Ord. Nos. 1 to 120,507	1	..	2½%	6	8 %	1⅛ — 1⅛	1⅛ — 1⅛	32/3	32/-	..	4 14 10
100,000	Do. do. 6% Non Cum. Pref. Nos. 1 to 100,000	1	6 %	6 %	6 %	6 %	1⅛ — 1⅛	1⅛ — 1⅛	..	..	..	5 1 1
200,000	Do. do. 5% Deb. Stk. Red.	100	5 %	5 %	5 %	5 %	103 —106	103 —106	..	..	..	4 14 4
40,000	St. James' and Pall Mall Electric Light, Ord.	5	12½%	10 %	10 %	10 %	8⅝ — 9	8¾ — 9	8¾	..	..	6 7 0
20,000	Do. do. 7 % Pref. 20,001 to 40,000	5	7 %	7 %	7 %	7 %	7 — 7¼	7 — 7¼	..	..	..	5 11 1
460,000£	Do. do. 3½ % Deb. Stock Red.	100	3 %	3½%	3½%	3½%	84 — 88	84 — 88	86½	..	..	3 19 7
12,000	Smithfield Markets Electric Supply, Ord.	5	4 %	Nil	Nil	Nil	⅛ — ¼	0 — 1/16	..	..	+1/16	Nil
85,000	South London Electric Supply, Ord.	4	4 %	3 %	4 %	5 %	2⅝ — 3	2⅝ — 3	..	..	..	6 13 4
120,000	South Met. Elec. Lt. & Power, Ord.	1	2½%	2½%	2½%	2½%	1/16 — 1/16	1/16 — 1/16	..	..	..	4 8 11
142,968	Do. do. 7 % Pref.	1	7 %	7 %	7 %	7 %	1⅛ — 1⅛	1⅛ — 1⅛	..	..	..	5 17 11
294,520	Do. do. 4½ % 1st Deb. Stk.	100	4½%	4½%	4½%	4½%	100 —103	100 —103	..	..	..	4 7 5
80,000	Urban Electric Supply, Ord.	5	5 %	5 %	5 %	5 %	⅜ — ½	⅜ — ½	..	..	..	25 6 8
60,000	Do. do. 5 % Cum. Pref.	5	5 %	5 %	5 %	5 %	1½ — 1⅝	1½ — 1⅝	27/6	..	..	14 5 4
275,000	Do. do. 4½ % 1st Mort. Db. Stk. Red.	100	4½%	4½%	4½%	4½%	74½ — 78½	74½ — 78½	..	..	..	5 14 8
808,000	Victoria Falls Power Co., Pref. Nos. 1 to 800,000	1	..	..	..	5 %	⅜ — ⅝	⅝ — 1	..	..	..	5 3 11
110,000	Westminster Electric Supply, Ord.	5	12½ %	12 %	10 %	10 %	8¾ — 9	8¾ — 8¾	8⅞	8⅞	— ⅛	5 12 8
81,279	Do. do. 4½ % Cum. Pref. Reduced from 5% since 31st Dec., 1905)	5	5 %	4½%	4½%	4½%	5 — 5⅛	4⅞ — 5⅛	5	..	— ⅛	4 5 9

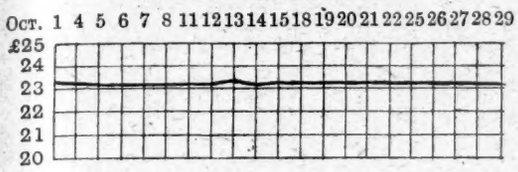
* Unless otherwise stated, all shares are fully paid. † Quotations on Liverpool Stock Exchange. Interim Dividend.

Bank rate of Discount 5 per cent., October 22nd, 1909.

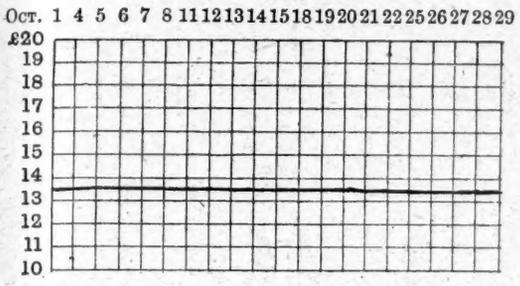
METAL MARKET.

Fluctuations in October.

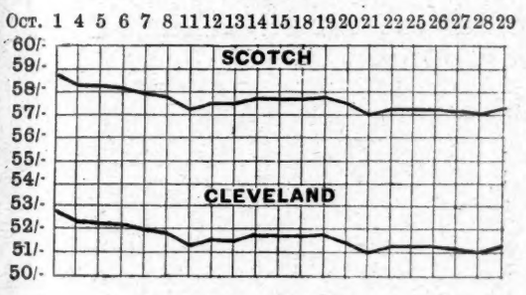
SPELTER (G.O.B's.).



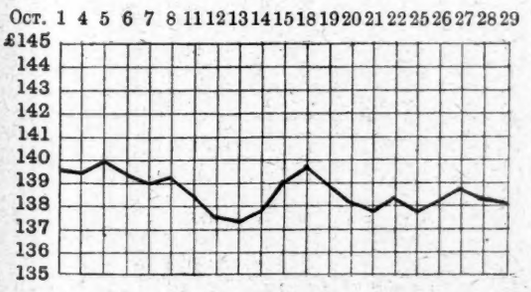
LEAD (ENGLISH).



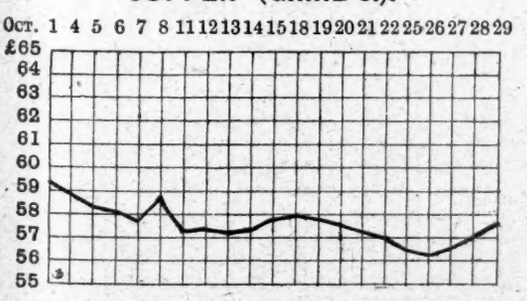
IRON.



TIN.



COPPER (G.M.B's.).

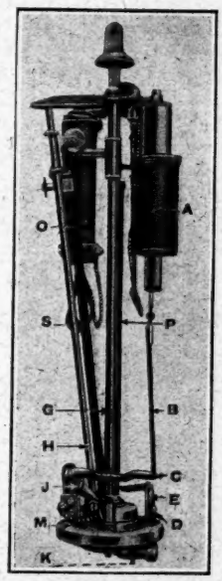


Radium in Sweden.—According to *Affärsvärlden*, a company has been formed in Sweden for the production of radium, of which, it is estimated, the output will be 4½ grammes yearly.

A NEW ARC LAMP WITHOUT CLOCKWORK.

The Regina-Bogenlampenfabrik, of Cologne, has recently introduced a lamp known as the "Conta Universal" lamp, which, possesses some novel features. It is called a Universal lamp because, besides being suitable for use with any type of ordinary round carbons, it is also possible to switch it over from direct to alternating current without any adjustment.

The carbons in this lamp are side by side and almost parallel, and they are geared together so that any motion of one is transmitted to the other. The end of the negative carbon P (see figure) rests with its point on a copper knob K below the economiser. This knob is attached to a bell crank D with a projection E above the economiser, which presses the carbon against the edge of the circular hole in the economiser. In this way a great part of the weight of the carbons is removed from the knob in consequence of the pressure exerted by the bell crank. The negative carbon, therefore, tends to burn to a very long point; when finally the point burns away the weight on the knob is removed and the pressure of the bell crank also ceases, and the carbon drops slightly until the point again rests on the knob. The material of which the knob is made must



Mechanism of the Conta Lamp.

have a high melting point and a high boiling point, must conduct heat readily and have large specific and latent heats. Copper, or some alloy having practically the same properties as copper, has been found to comply best with these conditions. The surface of the knob is made considerable, so that the heat is readily dissipated, and it is found that practically no wear takes place. In fact, when the experiment was made of weighing the knob before and after a 10-hour run, a very slight *increase* of weight was found to have occurred due to oxidation. There is no danger of the arc becoming transferred to the knob, as the latter forms no part of the circuit. The knob and bell crank serve another purpose in the lamp as well. The negative carbon holder above the carbon is reduced somewhat in diameter, so that when the carbon is practically burnt away, the bell crank can advance a little further forward than usual. This withdraws the knob and allows the carbon point to clear it, and the carbon then automatically drops out of its holder into the ash tray and the lamp is extinguished.

The striking of the arc is effected, as usual, by means of a series solenoid drawing up an iron core. This motion causes the positive carbon S, which is normally slightly out of the vertical with its point in contact with the negative carbon, to be set vertical, and so open the circuit at the points. A dashpot is added to prevent jerky operation. The ampere-turns of the solenoid are so chosen that even if the current fell 50 per cent. the iron core would not be released. Consequently, the solenoid is entirely out of action once the arc is struck, and it in no way helps in the regulation of the lamp.

The regulation is, in fact, effected naturally by the burning away of the negative carbon, although it is aided also by the presence of a blow magnet M above the economiser, and by the action of the economiser itself.

The blow magnet not only keeps the arc to the points of the carbons, but also tends automatically to regulate the current, for any increase of current causes the arc to be lengthened, and to increase in resistance, whilst a reduction of current, from any cause, weakens the magnet and shortens the arc. The economiser helps the regulation, from the fact that its inside is filled with inert gases, so that the consumption of carbon is much quicker when the arc is formed beyond the economiser than when inside it. Should the positive carbon therefore, from any cause, not burn

away as quickly as the negative one, it will project beyond the economiser, and will soon burn away to the right extent. If, on the other hand, the positive carbon burns away too quickly, its end will gradually recede within the economiser, and its rate of consumption will then be reduced.

The parallel position of the carbons in this lamp prevents the possibility of any very wide current variations, and consequently it is unnecessary to provide the special iron wire regulating resistances used in some recent simplified lamps.

When fitted with ordinary carbons, this lamp burns with about 80 volts, and, without any change even in the carbons, it can be switched over from a direct to an alternating supply if desired. —*E.T.Z.*

SOUTH KENSINGTON MUSEUM.

In amplification of the article on the electrical work at the new Victoria and Albert Museum, which appeared in the issue of the Electrical Review of August 27th, the figures given in the following table may be found of use to lighting engineers.

A few typical galleries only have been selected, but these give a very fair idea of the lighting of the whole building.

The figures in the column showing the approximate watts per square foot of floor space for the various methods of lighting are especially interesting, and, although no particulars are available of the difference in the resultant illumination, a visitor is able to judge of the effect for himself, and, with this table before him, to imitate or improve upon the results as he may consider desirable in any installations with which he may be dealing.

Similar figures have also been given for some of the galleries at the Natural History Section of the British Museum, which (as those members of the Institution of Electrical Engineers who are in the habit of attending the conversaziones are aware) has for some time been partially lighted, and the installation at which is being gradually extended.

Position.	Lamps.	Total watts.	Shape of room.	Approximate area.	Approximate watts per sq. ft. of floor.	Height of lights.
	VICTORIA AND ALBERT MUSEUM.					
	Enclosed arcs, 2 in series on 200 volts.			Sq. feet.		Ft. in.
(*a*) Octagon Court, No. 40. Ground floor ...	12 pairs of 8 amperes.	19,200	Octagonal, diameter 110 ft. + 4 apses	12,000	1·60	22 0
Central Court, No. 43. " " ...	5 " "	8,000	90 ft. × 50 ft.	4,500	1·77	"
West Hall, No. 48. " " ...	13 " "	20,800	230 ft. × 50 ft.	11,500	1·80	20 0
East Central Court, No. 44. " " ...	8 " "	12,800	90 ft. × 70 ft.	6,300	2·01	"
Gallery 121. First floor	2 pairs of 3 amperes.	1,200	34 ft. × 34 ft.	1,150	1·04	18 0
Gallery 122. " "	7 " "	4,200	107 ft. × 30 ft.	3,210	1·30	"
Gallery 21. Ground floor	8 " "	4,800	106 ft. × 31 ft.	3,290	1·45	"
(*b*) Gallery 142. Second floor...	5 " "	3,000	50 ft. × 34 ft.	1,700	1·76	17 0
	Metallic-filament Incandescents.					
(*c*) Gallery 114. First floor	46— 63 watts, clear.	2,898	500 ft. × 16 ft.	8,000	0·36	9 6
(*d*) Gallery 47. Ground floor	27—125 " "	3,375	" "	"	0·42	14 0
(*e*) Galleries 70—73. First floor	10—125 " "	1,250	145 ft. × 20 ft.	2,900	0·43	9 6
(*f*) Gallery 137. Second floor	84— 28 watts, obscured	2,352	107 ft. × 30 ft.	3,210	0·73	"
(*g*) Gallery 75. First floor	132— 28 " "	3,696	155 ft. × 31 ft.	4,805	0·77	"
Gallery 136. Second floor	8—125 " "	1,000	34 ft. × 34 ft.	1,156	0·86	"
(*h*) Gallery 131. First floor	116— 28 " " (32 clear).	3,248	107 ft. × 30 ft.	3,210	1·01	"
	Tantalums.					
(*i*) Galleries 22—24. Ground floor	168—40 watts, clear.	6,720	230 ft. × 35 ft.	8,050	0·83	14 0
	NATURAL HISTORY MUSEUM.					
	Inverted open-type arcs, 4 in series on 220 volts.					
(*j*) Bird Gallery. Ground floor	5 series of 10 amperes.	11,000	200 ft. × 50 ft.	10,000	1·10	11 0
(*k*) Gallery east of Hall. First floor... ...	2 " "	4,400	120 ft. × 18 ft.	2,160	2·01	11 0
	Flame arcs, 4 in series on 220 volts.					
(*l*) Main Hall. Ground floor	1½ series of 10 amperes.	3,300	120 ft. × 60 ft. (omitting side galls.)	7,200	0·46	30 0

Remarks.

(*a*) Lights hang in a circle: 41 ft. radius. (Except where otherwise stated, the lamps hang in two rows.)
(*b*) Lamps hang in an oblong.
(*c*) 19 of these points are two-light fittings having a spread of 4 ft. Fittings hang in a single row.
(*d*) Parts of this corridor receive a little additional light from the arcs in the adjoining courts. Lamps hang in a single row.
(*e*) This gallery is divided into 4 rooms, but with wide communicating openings. The lamps hang in a single row.
(*f*) 14 six-light fittings. Owing to position of beam, these fittings are hung too near the walls to give the best distribution of light.
(*g*) 22 six-light fittings.
(*h*) 14 six-light fittings; 32 lamps for top-lighting of wall-cases.
(*i*) 28 six-light ball pendants.
(*j*) 4 ft. 9 in. reflectors.
(*k*) Lamps hang in a single row.
(*l*) Alterations in contemplation.

EXTRAS.

[FROM A LEGAL CONTRIBUTOR.]

Of all the questions which arise from time to time between contractors and the persons who employ them, there are none more difficult than those which relate to extras. To draw a specification which shall include everything is well-nigh impossible. There must be an extra clause of some kind in the contract, and it is upon the construction of this clause that the chief difficulties arise.

It may be well, at the outset, to draw attention to one or two elementary principles of law in relation to extras. Assume that a contractor agrees to erect certain plant according to agreed plans and specifications for the sum of £1,000. Take the simple case in which there is no "extra" clause. When half-way through the work the contractor finds that, owing to a rise in the price of materials, he is unable to carry out the work, except at a loss. In such a case he cannot claim the additional cost to him as "extra" to the contract price. Again—to take another simple case—if the contract provides that no extras shall be allowed for unless they are ordered in a particular manner, the contractor can

have no redress unless the terms of the contract are strictly complied with.

It has been well stated that "In the absence of any provision in a contract that alterations or additions may be made in certain specified ways, the ordinary law of contract does not find any place for extras or alterations so-called, and any alteration or addition to the work originally contracted for must depend upon a new contract, express or implied."

Works which are indispensable to the performance of the contract cannot be regarded as extras. This is for the reason that those who employ a contractor are entitled to rely on his skill and judgment to put in what is right and proper for the purpose of making a satisfactory job. Hence, although details which were known to be clearly necessary for the purpose of carrying out the work are not expressly mentioned in the specification, yet the contractor will not be allowed to charge for such evident omissions as extras. For instance, when the specification omitted to refer to flooring, it was held that flooring could not be charged for as an extra to a contract for the building of a house (Williams *v.* Fitzmaurice 3 H. and N. 844).

No contract of any magnitude is ever signed unless it contains an "extra" clause. It will be convenient to consider the form which such a clause usually takes. As a rule, the duty of deciding questions relating to extras is left to the architect or the engineer, as the case may be.

A vexed question may arise with regard to extras ordered by the employer himself. Suppose that, in the case of a building contract, the building owner is constantly on the job watching all that is going forward. In these circumstances, alterations and improvements will be constantly occurring to his mind, and he may direct the builder to make changes without waiting for the approval or written authority of the architect. In such circumstances, it is conceived that he would be liable to pay for any extra work ordered by him. But the mere fact of the employer having assented to certain alterations is not sufficient to make him liable to pay for them as extras, unless he is either expressly informed or must necessarily, from the nature of the work, be aware that the alterations will increase the expense (Lovelock *v.* King, 1 M. & R. 60). But when it was shown that, in the progress of building, some process more expensive than that contracted for was ordered by the architect, with the knowledge of the employer, who was present at the time, and the builder's sub-contractor was told that it was to be charged as additional work, it was considered that there was sufficient evidence of a contract to pay the builder extra for it, and of authority in the architect to make such a contract with him (Wallis *v.* Robinson, 3 F. & F. 307).

The following is a common form of clause which deals with alterations and extras: "If any part of the said materials or work shall be ordered not to be used or done respectively under the handwriting of the engineer, the same shall be withdrawn, and the difference of expense occasioned thereby shall be deducted from the amount hereby agreed to be paid to the builder, and in like manner if the employer or the engineer shall in writing under his hand order any materials or work to be used or done, not included in this contract, the difference of the expense to be so occasioned shall be added to the amount of the sum hereby agreed to be paid, but no account or allowance shall be had or made in respect of any work omitted to be done, nor of any extra work which shall be done, unless the same be omitted or done by an order in writing under the hand of the employer or of the engineer; and all accounts and allowances for such omission or extra work respectively shall be ascertained and settled by the engineer from time to time as they shall be made or take place, and his decision shall be final and binding on both parties."

The foregoing clause makes it necessary for all extras to be sanctioned in writing, either by the employer or the engineer. This is of enormous importance to both parties, inasmuch as it tends to prevent any question arising as to whether extras have or have not been ordered. But what constitutes an order in writing? It has been decided that a sketch made by an architect and not signed by him, is not such a direction as complies with a contract containing a clause similar to the above (Myers *v.* Sarl, 30 L.J.Q.B., 9), but even apart from that decision no prudent contractor would embark upon any extra work without a definite order in writing.

The following cases may serve to illustrate how strictly the terms of such a clause must be observed. In Lorden *v.* Pryce ("Emden's Building Contracts," 4th ed., page 105), a building contract provided that orders for extras were to be signed by the secretary and treasurer of the employers, and countersigned by the architect. The builder having completed the work, the architect issued a final certificate which apparently included certain extras not signed for by the secretary and treasurer. It was held that the builder could not recover for such extras.

Where a contract provided that no claim should be made for extras without the written order of the architect, and no such written order as stipulated for was given, it was held that the *final* certificate of the architect, including such extra work, was conclusive, and that neither party could raise the question of whether or not there was a sufficient order in writing (Goodyear *v.* Weymouth 1 H. & R. 67). It is to be observed, however, that although the *final* certificate may be conclusive as to extras for which no written order as stipulated for has been given, this is probably not the case with progress certificates. So where a contract provided that no alterations or additions should be made without a written order from the employers' engineer, and during the execution of the contract the contractors were allowed to erect certain addditional works, and the particulars were entered in the "progress certificate," the House of Lords held that these certificates were not written orders, and that the claim was, therefore, excluded by the terms of the contract.

The question whether the architect or engineer employed in connection with a contract has power to order extras remains to be considered. The architect or engineer is only the agent of his employer to see that the works contemplated by the contract are carried out properly; he cannot, without authority, bind his employer to pay for additional work. Where, therefore, extra work is done by order of the architect, the builder must show an authority in the architect to give directions for extra work, and, when the architect is shown to be the employer's agent to bind him by any deviation or addition, it will be necessary to inquire whether the agency of the architect to order extras was general, or was limited to a specified extent (see "Emden's Building Contracts," 4th Edition, page 187).

It is material to notice that there are cases in which work in the nature of extra work may be claimed for, although the contract contains no "extra" clause. So where something has been done by the builder, beyond what he has to perform according to the special contract, and that has been done at the instance of the employer, the price of extra work, not being under the contract at all, can be recovered as for work and labour done; yet the contract must be proved in order that it may appear how much was extra.

If the builder, in completing a contract for a stipulated price, use materials of a better kind than those contracted for, he is not at liberty, on that account alone, to charge more than the stipulated price, nor, of course, can he require the materials worked into the building to be returned, because the employer will not pay an increased price on account of the better materials. (Wilmot *v.* Smith, 3 C. and P. 453.)

Canadian Boiler Regulations.—Mr. F. E. Leonard brought before the annual convention of the Canadian Association of Stationary Engineers this year the discrepancies which at present exist between the Acts of the different Provinces governing the construction and inspection of steam boilers. One province allows the usual re-inforced manhole in the shell, while another calls for the flanged-in or ellipse pattern. One will allow a cast-iron steam nozzle; another insists on cast-steel. One province allows the safety valves to blow off from the top; its neighbour insists on a side outlet. The provisions as to supports are equally confused. British Columbia was the first to lead the way in boiler legislation, while Ontario and Quebec have not put any restriction on industrial development. Mr. Leonard pleaded for co-ordination in these rules, so that a boiler might be purchased in any part of the Dominion and used anywhere from the Atlantic to the Pacific, if it had a certificate of inspection. The matter is a very important one to boiler manufacturers and central-station equipment firms in Great Britain who do an export trade to Canada, and should be the subject of their careful attention.

CABLE-FAULT LOCALISATION GRAPHS IN PRACTICE.

By EDWARD RAYMOND-BARKER.

(*Continued from page* 672.)

The Heurtley Test Considered Graphically.

Mr. E. S. Heurtley, as an investigator of problems connected with exact localisation of copper-exposure faults or breaks in submarine cables, has, in the use of artificial copper-exposures, made an interesting step in advance. He does not merely compare test results from a real broken cable with those from an artificial "end" of more or less superficial area of exposed copper; he combines the comparison, so to speak, into one operation, and balances the broken or faulty cable with its natural exposure against the balancing resistance *plus* an artificial exposure.

The writer is aware that some good individual work in this direction was done many years ago by Mr. John Gott, and that this exposure-balance system had, in 1893, been clearly suggested by Messrs. G. K. Winter and G. B. Winter.* Mr. Heurtley, however, has reduced the matter to a complete system, and to an extremely simple formula with factors easily obtained.

Connections for Heurtley's test are shown in fig. 50 in combination with an extra resistance r and key K_2 which enable all bridge readings to be made to *false zero* by Mr. R. R. Black's reduced-current method, by means of which inconstancy of polarisation at f is minimised owing to a certain amount of testing current being made to flow steadily to line throughout the test, without the usual earthing intervals and disconnections of battery which accompany ordinary false-zero testing.

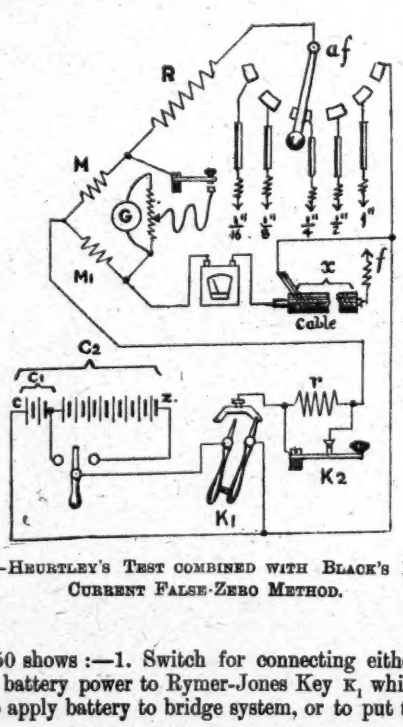


Fig. 50.—Heurtley's Test combined with Black's Reduced-Current False-Zero Method.

Fig. 50 shows :—1. Switch for connecting either higher or lower battery power to Rymer-Jones Key K_1 which serves either to apply battery to bridge system, or to put the latter to *earth*.

2. Extra resistance r inserted between K_1 and bridge, and short-circuited at will by K_2.

3. A mil-ammeter which will be found useful to measure testing-current entering cable, if any plotting is to be done for *graphs*.

4. Resistance R used to balance x and fault or break, and connected to a switch by means of which R can be earthed direct to cable sheathing, or at choice through any one of several lengths of cable core—say, 130 Cu/130 G.P.—immersed in *earthed* salt water, and having at their further several extremities ($a\ f$) copper exposures varying from, say, 1 in. of conductor to a flush cut.

It is well here to note that smaller exposures than the above can be produced by a slit made with a sharp knife in the gutta-percha of the immersed core, and opened out or closed up as occasion may require for the balancing of f. Here, then, the cable *plus* the real fault or break f can be balanced against R *plus* the artificial fault or break $a\ f$—

So, when E.C. = zero,

balancing with higher current C_2 :—

$$x + f = R + af$$

with smaller current C_1 :—

$$x + f_1 = R_1 + af.$$

Heurtley has pointed out that the higher power is to be as high, and the lower as low as possible, as long as the test with the lower is not too insensitive. A current ratio 5 to 1 will often be found convenient.

The now well-known conditions based on investigational developments by Mance, Kennelly, Schaefer, and others have been aptly summarised by Heurtley in the following axioms :—

1. All exposures of equal effective area are, with the same current passing, of equal resistance, and vary equally in resistance under similar changes of the testing current.

2. That with two exposures of unequal area, that having the smaller area will not only have the higher resistance, but will vary more in resistance with a similar change in current, than the larger area.

3. That, other things being equal, the smaller the testing current, the greater the resistance of an exposure.

In developing the rationale of his test, Heurtley points out three cases to be considered :—

1. When the effective exposures at f and at af are equal or $f = a\ f$.

2. When exposure at $a\ f$ is greater than that at f or $af > f$.

3. When exposure at $a\ f$ is less than that at f or $af < f$.

From consideration of these three cases, Heurtley draws the following deductions :—

1. If resistance R remains the same for all strengths of current, then R = resistance up to the fault.

2. If resistance R with the higher current is less than that with the lower, then both these resistances are higher than the actual resistance up to the fault, and the artificial exposure ($a\ f$) is too large.

3. If the resistance R with the higher current is more than that with the lower current, then both these resistances are less than the actual resistance up to the fault, and the artificial exposure is too small.

4. In all cases, the result obtained with the higher current is a closer approximation of the resistance up to the fault than that obtained with the lower.

The practical routine of Heurtley's test is as follows :—

1. K_1 moved over so as to permanently apply battery (Z to L) to bridge.

2. False zero noted by R. R. Black's reduced-current method, viz., with K_2 depressed and r thereby inserted sufficient to about halve the testing current. Bridge resistance R to be adjusted till galvanometer deflection remains the same whether r be in or out. Obviously, owing to the capacity of the cable, the galvanometer, for the avoidance of undue deflection disturbance, must be short-circuited, or cut-out, during the actual depression or raising of K_2, *i.e.*, at the moments respectively of decrease or increase of the testing current. For this purpose, it is well in practice to have K_2 and the galvanometer key near each other for convenience in co-ordinate manipulation.

For each exposure condition, the above operation is effected twice, viz., first with the higher power and then

* In a communication by G. K. Winter and G. B. Winter, published in the *Journal* of the Institution of Electrical Engineers, No. 106, Vol. XXII, June, 1893, the following passage appears:— . . . . "It seems to us, however, that by putting an artificial fault at the end of the balancing resistance, we not only eliminate directly the false resistance due to polarisation, but by altering the size of the exposed wire at the artificial fault until the measured resistance remains the same whether the testing current used be small or large, we may arrive, without calculation, at the result aimed at."

with the lower. During the whole test the current is kept on permanently, alteration from a higher to a lower power, and *vice versa*, being effected by means of a sharply manipulated switch.

When an exposure (*a f*) has been found which causes R to remain the same whether the higher or the lower power be applied, then (with equal bridge ratio), R = X. It is not, however, necessary to exactly balance *a f* with *f*.

All that is really necessary is for a test to be made under two exposure conditions, one with the artificial exposure too large, the other with it too small.

Each of these two tests is, of course, made with a higher current and a lower current, the balance being made as close as is easily practicable. The mean of the two bridge readings (R) with the higher power (viz., with *a f* too large, and *a f* too small) gives *x*.

Before any practical examples are given, a short inquiry may be made into the graph aspect of this test, for which reference may be made to fig. 51.

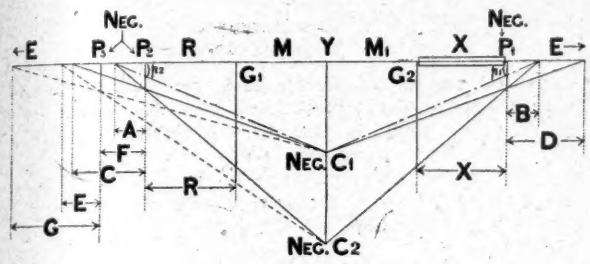


FIG. 51.

M, M_1 are bridge ratio resistances, taken as equal throughout.

Resistance R balances X, viz., that of broken cable (both to *earth* E).

Artificial copper-exposure in core immersed in earthed salt water, and connected to R, balances real exposure in the core of cable X, the broken end or fault being in the sea.

At bridge apex Y are applied higher and lower battery powers, Z to L, corresponding to C_2 and C_1.

G_1 and G_2 are points to which would be applied the galvanometer, for simplicity, here omitted.

P_1 represents polarisation P.D. at break.

P_2 is polarisation P.D. at artificial exposure.

P_1 and P_2 are opposite in *sign* to the P.D.'s primarily due to Cu-Fe elements at the two exposures previous to the application of the negative testing current.

A and B represent apparent increase in resistance, due to opposition of P_2 and P_1 to higher testing power C_2. C and D represent further apparent increase in resistance, due to opposition of P_2 and P_1 to lower testing power C_1.

Under the above conditions with both natural and artificial Cu exposures of equal effective area, on application of C_2,

$$X + B = R + A,$$

and with C_1 applied,

$$X + D = R + C.$$

But the two exposures being equal and—let it be granted—under uniform conditions in regard to cleanness of copper surface, and earth-connection resistance,

A = B and C = D. Therefore, R = X.

Let—for the sake of argument—the artificial exposure be of smaller effective area than that of the cable conductor. F then represents the consequent extra resistance at the artificial exposure, P_2 the polarisation P.D., E and G the apparent increased resistance due to the opposition of P_2 respectively to C_2 and C_1.

Under these conditions, that is to say, unless R be readjusted to a lower ohmic value, there is no balance, for with C_2, X + B < R + F + E.

With C_1, X + D < R + F + G.

A Heurtley test may best be made under conditions permitting the use of comparatively low testing currents, the relative value of the higher to the lower being, at the same time, as high as is practicable, not 2 : 1 as shown in fig. 51. A proportion 5 to 1 has given good results. A Heurtley balance—as has been shown—is obtained when the artificial exposure is so adjusted that bridge readings under the higher and under the lower testing current remain the same.

A graphic illustration of this is seen in fig. 51, if for the sake of argument we suppose the ratio between the higher and the lower testing currents to be much higher than the 2 : 1 shown in the diagram.

M and M_1 being equal, we have with power C_2 the equation X + B = R + A with respective polarisation P.D.'s, P_1 and P_2. Then with power C_1, X + B = R + A with respective polarisation P.D.'s P_1 and P_2.

But A = B ∴ R = X.

Any natural or telluric earth current from the cable would be accounted for by the two bridge readings being observed to false zero, if possible, by R. R. Black's reduced-current method as before described. The lower testing current must be sufficiently high to well overcome any possible natural, *i.e.*, telluric, current flowing counter to it.

In practice, however, as has already been shown, it is unnecessary to arrive at a perfect balance. On the contrary, when a fairly close approximation has been arrived at, the arithmetic mean of the two higher-current bridge readings (one with the artificial exposure too large, the other with it too small) gives X, viz., resistance up to fault or break.

Some actual tests by the Heurtley method are here tabulated. The table includes (*b*) number of Leclanché cells with corresponding effective current passing to line, and $\frac{1}{\sqrt{\text{m.a.}}}$ values with corresponding bridge readings, also details as to length of copper conductor exposure (core 130 lb. Cu/130 lb. G.P. per N.M.) and the reduction—or increase as the case may be—of A E the area of artificial exposure.

Test No.	(*b*) Cells Z to L.	M.A.	$\frac{1}{\sqrt{\text{M.A.}}}$	Bridge readings (F.Z.).	A.E.	Remarks re A E.	Graph plotting (See fig. 53).
				ω			
1	25	5·3	0·434	6,013	½ in.	Too large.	A.
	5	1	1	6,020			
	25	5·3	0·434	**6,010**	reduced	Still too large.	B.
	5	1	1	6,013			
	25	5·3	0·434	**5,997**	again reduced	Too small.	C.
	5	1	1	5,996			D.
2	20	11·6	0·294	1,250	1 in.	Too large.	E.
	5	2·8	0·598	1,253			
	20	11·6	0·294	**1,241**	½ in.	Balance.	F.
	5	2·8	0·598	**1,241**			
3	20	11·5	0·295	**1,251**	1 in.	Too large.	G.
	5	2·8	0·598	1,257			H.
	20	11·5	0·295	**1,217**	$\frac{1}{16}$ in.	Too small.	I.
	5	2·8	0·598	1,213			J.
4	20	9·6	0·323	1,261	1 in.	Too large.	K.
	5	1·1	0·954	1,382			L.
	20	9·7	0·321	1,231	$\frac{1}{16}$ in.	Still too large.	M.
	5	1·1	0·954	1,319			N.
5	20	13·0	0·277	1,248	1 in.	Too small.	O.
	5	4·1	0·494	1,222			P.
	20	13·0	0·277	1,218	$\frac{1}{16}$ in.	Much too small.	Q.
	5	4·1	0·494	1,179			R.

NOTE:
25 cells = 37·5 volts.
20 „ = 29·7 „
5 „ = 7·4 „
In Test No. 4, E.C. = 3° against testing current.
„ No. 5, E C. = 3° assisting „ „

The writer is indebted for test No. 1 to the kindness of a friend. This test, believed by the writer to have been made by Mr. E. S. Heurtley, was made on a broken cable, and gave the result—

$$\frac{6{,}010 + 5{,}997}{2} = 6{,}003{\cdot}5 \text{ ohms.}$$

This was 1·5 ohms more than what eventually proved to be the correct resistance—viz., 6,002 ohms.

For the bridge readings in Nos. 2, 3, 4 and 5, which were made on an artificial cable and with artificial exposures, the writer is indebted to a colleague—Mr. J. G. H. Grey.

In tests Nos. 2, 3, 4 and 5 the correct resistance up to break was in all cases 1,240 ohms (ctd.). Readings were noted to F.Z. by Black's reduced-current method.

No. 2 affords an example of an exact balance—viz., 1,241 ohms, with both higher and lower testing currents; error, 1 ohm (+).

No. 3. The mean of the two readings with the higher current, or— $\frac{1,251 + 1,217}{2} = 1,239$ ohms. Error, 1 ohm (−).

No. 4. During this test the cable was influenced by an artificial telluric E.C. of 3 volts in opposition to the negative testing current. In this test the exposure adjustment was left incomplete, for a purpose which will be explained further on. The same remark applies to test No. 5, in which the conditions were similar to those in No. 4, excepting that the E.C. was not opposed to, but was in the same direction as the negative testing current.

(To be continued.)

THE ELECTRICAL TRADE AND RAILWAY RATES: INEQUALITY AND INCONSISTENCY.

By S. WHETTALL.

In certain sections of the electrical trade there has been a reduction in the cost of production and also a lowering in the prices at which the manufactured articles have been sold, but there has not been any proportionate reduction in the railway carriage charges, which therefore constitute a greater proportion of the price when sold and delivered than was hitherto the case. The reader will, therefore, probably appreciate the particulars given in this short article, and admit that the subject affects most traders connected with the electrical business in this country.

It has been evident for a long period that some traders have an advantage over others in connection with the railway carriage charges over equal or proportionate distances owing to the said rates being unequal, and when it is recollected that the electrical trade will probably pay over £4,000,000 in railway carriage charges every year, then the importance of the question of the disproportionate railway rates will be appreciated by traders and others interested in railway rates and in matters pertaining to railways.

To give the reader a clear idea of the subject under discussion, it may be as well to mention that railway rates are divided into eight sections or classes, and those which more particularly relate to the electrical trade are Classes C, 1, 2, 3 and 4.

Class C includes such traffic as cable tubes.

Class 1 includes such traffic as accumulator plates.

Class 2 includes such traffic as accumulator dynamos and motors.

Class 3 includes such traffic as electric arc lamps, &c.

Class 4 includes such traffic as electrical instruments, &c.

Class C rate includes the station terminals for use of railway company's stations, the service terminals for use of railway companies' sheets, loading and unloading, covering and uncovering, and also the rate for conveyance over the railway, which includes the wagon hire for use of the railway company's wagons. Cartage is not included in the rate for Class C traffic, and if cartage is performed by the railway company it is, of course, additional to the rate.

Class rates 1, 2, 3 and 4 include all the charges given as being included in Class C rate; the charge for cartage within the ordinary boundary is also included in these rates, with, however, some few exceptions. That the inconsistencies in railway rates are many cannot be gainsaid, and seeing that this is so, a wide field for discussion is opened up, and the tables given hereafter will probably throw some light upon a rather intricate matter.

Table I represents the station and service terminal charges.

Table II shows the maximum rates of conveyance.

Table III represents the actual mileage rates in operation between the places for traffic in Classes C, 1, 2, 3 and 4.

Table IV shows the class C rate as based upon the maximum service and station terminal charges plus the maximum conveyance charge.

The particulars given above will give the reader some idea as to the composition of the rates, and to make the subject clearer all details with respect to the rate charges are given hereunder:—

Maximum terminals along with conveyance charges constitute the basis of all railway rates with, however, one exception, and that is, cartage.

TABLE I.—Maximum Terminals—Per Ton.

In respect of merchandise comprised in classes.	Station terminal at each end. s. d.	Loading. s. d.	Unloading. s. d.	Covering. d.	Uncovering. d.
C	1 0	0 3	0 3	1	1
1	1 6	0 5	0 5	1½	1½
2	1 6	0 8	0 8	2	2
3	1 6	1 0	1 0	2	2
4	1 6	1 4	1 4	3	3

TABLE II.—Maximum Rates of Conveyance.—Per Ton Per Mile.

In respect of merchandise comprised in classes.	For the first 20 miles, or any part of such distance.	For the next 30 miles, or any part of such distance.	For the next 50 miles, or any part of such distance.	For the remainder of the distance.
C	1·80d.	1·50d.	1·20d.	0·70d.
1	2·20d.	1·85d.	1·40d.	1·00d.
2	2·65d.	2·30d.	1·80d.	1·50d.
3	3·10d.	2·65d.	2·00d.	1·80d.
4	3·60d.	3·15d.	2·50d.	2·20d.

It should be noted that the conveyance rates shown above are not universal, as they differ slightly over some companies' lines, as sometimes they are fractionally less, and sometimes slightly higher, than those given above. It may also be mentioned that in some parts of the country a small toll is charged (for various reasons and purposes), and the toll is usually 1d. or 2d. per ton.

TABLE III.—Actual Mileage and Actual Rates in Operation.—Rate per Ton.

Between Grimsby and—	Miles.	Class. C. s. d.	Class. 1. s. d.	Class. 2. s. d.	Class. 3. s. d.	Class. 4. s. d.
1. London	155	18 3	28 7	35 11	41 9	50 1
2. Birmingham	132	16 11	23 7	26 3	33 8	40 2
3. Manchester	91	13 4	20 0	23 9	27 1	31 8
4. Leeds	53	7 11	11 8	13 4	16 8	20 0

TABLE IV.—Class C Rate, as Based upon the Maximum Station and Service Terminal Charges plus the Maximum Conveyance Charges.

Miles.	Station terminal at both ends. Per ton. s. d.	Service terminals. Per ton. d.	Maximum conveyance rate according to actual mileage. Per ton. s. d.	Total. Per ton. s. d.
1. 155	2 0	8	15 0	17 8
2. 132	2 0	8	13 8	16 4
3. 91	2 0	8	10 11	13 7
4. 53	2 0	8	7 1	9 9

TABLE V.—Class 1 Rate, as Based upon the Maximum Station and Service Terminals plus the Maximum Conveyance Charges and an Approximate Allowance for Cartage.

Miles.	Station terminals at both ends. Per ton. s. d.	Service terminals. Per ton. s. d.	Maximum conveyance rate according to actual mileage. Per ton. s. d.	An approximate allowance for cartage both ends. Per ton. s. d.	Total. Per ton. s. d.
1. 155	3 0	1 1	18 9	5 6	28 4
2. 132	3 0	1 1	16 10	3 0	23 11
3. 91	3 0	1 1	13 2	3 0	20 3
4. 53	3 0	1 1	8 9	3 0	15 10

A comparison, showing where the inequality of the rates is apparent, will be found in the following table:—

	Class C. Actual rate in operation. s. d.	Class C. Maximum basis rate per ton. s. d.	Class 1. Actual rate in operation. s. d.	Class 1. Maximum basis rate per ton. s. d.
London ...	18 3	17 8	28 7	28 4
Birmingham..	16 11	16 4	23 7	23 11
Manchester...	13 4	13 7	20 0	20 3
Leeds ...	7 11	9 9	11 8	15 10

From the figures, it is easy to understand that traders in Leeds have an advantage over other towns when traffic is forwarded thereto from Grimsby, and this instance is only one of many, so that one naturally asks why should railway rates be cheaper in one part of the country than they are in another; the only inference to be made is that the railway rates require adjusting.

Another instance of the inequality of railway rates is given hereunder, showing that such inequalities prevail all over the country :—

		Class C rate actually in operation. Per ton.	Class C rate as based upon the maximum terminals and conveyance charges. Per ton.
	Miles.	s. d.	s. d.
Bristol and London	118¼	13 1	15 7
Birmingham ...	87¾	10 6	13 3
Manchester ...	166	18 4	18 4
Leeds	202¼	20 4	20 4

In this case it will be seen that the traders in London and Birmingham receive a certain amount of benefit over and above probable competitors in either Manchester or Leeds, and such instances as these clearly prove the need of reform or amendment in railway rates, as it is unjust that some traders should obtain better rates than others.

OVER-RUN AIR PUMPS.

[COMMUNICATED.]

Engineers who are a little careless of their pipe joints have to pay for the same in poor vacua. This poor vacua they then endeavour to cure by over-running the air pump. Doing this is perfectly useless, and pays about as well as the endeavour of a man to lift himself by his own boot straps. To over-run an air pump is to vitiate the vacuum, for it is not possible under ordinary conditions to secure its best efficiency above a certain speed. Let an Edwards air pump be taken as an example. When the bucket descends, its conical base projects the water which has gathered in the conical bottom of the casing, round a curved passage into the pump barrel. The prompt return of the bucket covers the port through which the water has been shot, and through which also the air from the condenser has entered the almost vacuous space above the bucket. The two fluids are more or less converted into foam, and this proceeds to settle upon the face of the bucket in a layer of water and a superincumbent layer of air. Given time, this separation would be complete and the air would be discharged through the upper valves, followed by the excess of water beyond that requisite to fill the clearance space, but without sufficient time there cannot be complete separation, and there will remain on the bucket the clearance volume of foam at atmospheric pressure. The air of that foam expands on the down stroke of the bucket, and the vacuum formed above the bucket fails to attain to that proper to the temperature of the water; less air enters the ring port and the efficiency of the pump is permanently reduced. By slower running, such a pump would have a better efficiency. Because of this foaming, the clearance above the bucket should be a minimum in order that the clearance layer shall, if possible, be solid water, so as to ensure the fullest discharge of the foam layer. An inefficient pump may be improved by attending to the clearance. In an Edwards pump, wear of the bearings tends to shorten the rod and reduce the clearance, so that a pump needs to be watched against entire disappearance of clearance as well as against the lining up of bearings to give too long a rod and excess clearance.

In considering the interaction between an air-pump and the condenser to which it is connected, two conditions are prominent. Assuming the air-pump clearance is filled with water, the vacuum formed above the bucket is simply that due to the pressure of aqueous vapour. In the condenser, assuming the same temperature, there are two pressures combined—that of the aqueous vapour and that of the air which is present. The absolute pressure in the condenser is greater than that of the air-pump space by the amount of the partial pressure of the air. But two different pressures cannot exist in free communication, the gas at the higher pressure must rush into the lower pressure space until equilibrium is maintained. When the air-pump bucket opens this communicating passage, the mixed vapour rushes in from the condenser; this raises the pressure in the pump chamber, and the vapour already there partially condenses; and this action goes on until the inrushing vapour has carried with it so much air as to bring the ratio of air to aqueous vapour to the same figure in each vessel.

It is, of course, still assumed that the water temperature remains equal in both vessels. Presumably if a vessel of water is hotter at one end than at the other, any air that may be present will collect at the colder end in order to bring the sum of the two partial pressures of air and water vapour to the same figure. This is the scientific reason, in addition to others, why air is best drawn from the coolest part of a condenser, and it would conduce to efficiency of an air pump could its barrel be well cooled. Apparently the Edwards air pump, with a continuous small cold water spray into the barrel to maintain a full clearance space, would act well as a dry air pump, the water being removed from the condenser by a wet pump or even barometrically. Such a pump would represent a thoroughly cold end to the condenser, into or towards which air would rush automatically to maintain equilibrium of pressure. The laws of mixed vapours tell us that the space above water of a given temperature will always contain a definite weight of aqueous vapour per unit of space irrespective of the presence of other gases. This law underlies the action of the air pump, and explains why air will rush into a space until the ratio of air is brought up to that of the space whence the air flowed.

Equalisation of pressure is, of course, instantaneous or practically so, the molecular velocity of the gas or vapour involved being many hundred feet per second, and time being therefore negligible. But time is not negligible when there is any question of the settling out of foam into its constituents, gaseous and liquid. Hence the danger of over-running.

PROCEEDINGS OF INSTITUTIONS.

The Electrical System of the L.C.C. Tramways.

In connection with the above paper, by Mr. J. H. Rider, which was read at the meeting of the I.E.E. on March 25th last and discussed on two subsequent dates, our readers will remember that Mr. Rider's reply was held over owing to shortness of time. As many of the points raised were of considerable interest, we briefly extract some of Mr. Rider's remarks from his published reply in the *Journal* of the Institution of Electrical Engineers.

Mr. Rider said he considered the change of site from Camberwell to Greenwich to have been justified by the results; it had to be remembered that the railway company stipulated that the proposed siding at Camberwell should only be used for three hours in the night. A recent quotation by London coal merchants for Scotch coal showed a saving of 2s. 3d. per ton delivered at Greenwich as compared with Camberwell; there was also the question of condensing to be considered, as cooling towers would certainly have proved a public nuisance. He doubted whether the site would have been big enough to contain cooling towers for 22 million lb. water per hour. He could not agree that 25 per cent. spare boiler plant was too much if the best results were to be obtained; the new Babcock boilers were bigger than the original Stirling units, and anything larger would have involved more costly buildings. The type of reciprocating engine adopted at Greenwich was from experience the best for large powers, and its speed had not proved too high. The 6,600-volt pressure for transmission was adopted as being low enough to get rid of many of the electrical troubles experienced at higher pressures, while still sufficiently high for satisfactory economy when the average distance and load density were considered. Experience had shown that the 85 per cent. power factor for which the turbines were designed was more in accordance with actual work than the 94 per cent. of the reciprocating plant. The power factor of the plant as a whole, at full load was from 90 to 93 per cent.; at half load from 80 to 85 per cent., and at light load during the night about 70 per cent. Considerable economies had been found from the turbines which were run on heavy constant load, the reciprocating plant filling up the hollows, and also working at its most economical load, viz., ¾ full load. The coal consumption per unit delivered to sub-stations had decreased by something like 20 per cent. since the beginning of 1909. The impulse turbine was not adopted for extensions, because the author hoped to obtain any more reliability with it on account of larger radial clearances. The aim of the station was to maintain an outside supply under all conditions, and the author considered that nothing but a hand-operated switch could be relied on to pull a machine out of circuit, in the event of a failure of the machine itself. With the present system of earthing, no trouble was ex-

perienced with the A.C. motors driving the centrifugal pumps. As regarded sub-station efficiency, the average of the synchronous sub-stations was 73·5 per cent., and of the induction sub-stations 82·1 per cent., but this did not necessarily indicate the comparative efficiencies of the two types of plant. There was nothing like one-third spare plant in the sub-stations, which frequently operated on their overload capacity.

In reply to several speakers who drew attention to the heavier energy consumption per car-mile of the L.C.C. cars as compared with other cities, notably Glasgow, he pointed out that if allowances were made for the greater weight and higher speed of the London cars, and the frequent traffic stoppages, it would be found that there was no great difference between the energy consumptions in the two cases.

Institution of Electrical Engineers (Manchester Section).

The opening meeting of the session of the above Section was held on Friday evening, the 22nd ult., when the chairman, Mr. S. J. Watson, delivered his inaugural address.

Referring first to the steps recently taken by the Council to acquire the Medical Examination Hall on the Victoria Embankment as a permanent home for the Institution, Mr. Watson expressed the opinion that such a centre could not fail to be of immense advantage to the Institution, and that a grave error in judgment would have been made if full advantage had not been taken of the opportunity when it arose. He regretted that during the last few years there had at times been a difficulty in obtaining suitable papers for Institution meetings. It was necessary in some cases for members to obtain permission from their employers before offering a paper, and permisson was, he was afraid, sometimes withheld on the grounds that the information given might be used to the prejudice of such employers. While there were doubtless some trade secrets that could be maintained absolutely inviolable, he did not think there was very much electrical manufacturing work carried out that might be classified under this heading. Most electrical manufacturers had received benefits in one way or another from the work carried on by the Institution, and in return they should do what they could to encourage their employés to join the Institution and contribute to its success.

He had also found that members who were engaged on the manufacture of special apparatus did not care to offer papers on the subject they were most intimately acquainted with because they were afraid competitors might consider they were trying to obtain a cheap advertisement. Such a feeling could be carried too far. Most of them had to specialise in one direction or another, and those whose everyday work was in one direction were just the men most capable of giving information in regard thereto.

Dealing with the development of electric supply undertakings during the past 15 years, he could not help being impressed with the remarkable growth that had taken place during a comparatively short period of time. He had prepared a table giving a summary of the records contained in issues of *Lightning* and the *Electrical Times* in 1894, 1899, 1904 and 1909, so that they would see the improvements which had taken place during three periods each of five years.

Records of Supply Undertakings.

	1894.	1899.	1904.	1909.
No. of undertakings	30	100	225	290
Cap. expenditure, £	4,472,925	11,895,993	38,284,458	57,818,142
Plant installed, KW.	32,108	112,631	454,565	795,036
Inc. in capital, £ ...	...	7,423,068	26,388,465	19,533,684
Inc. in plant, KW. ...	...	80,523	341,934	340,471
Cap. outlay per KW.	£139	£105	£84	£72
Cost per add. KW. ...	...	£92	£77	£57
Maximum load, KW.	...	78,866	269,680	501,941
% to plant installed	...	70	59	63
Units sold	15,231,181	76,432,250	349,003,935	824,819,503
Increase in output...	...	61,201,069	272,571,685	475,815,568
% increase	...	401	357	156
Units sold per £1 expended ...	3·4	6·4	9·1	14·2
Units per add. £1 expended ...	...	8·2	10·3	24·4
Revenue	£392,077	£1,556,262	£4,763,111	£7,528,321
% to capital ...	8·7	13·1	12·4	12·8
Inc. in revenue, £...	...	1,164,185	3,206,849	2,665,210
Revenue per unit ...	6·16d.	4·89d.	3·27d.	2·16d.
Rev. per add. unit	...	4·55d.	2·82d.	1·34d.
Working expenses, £	243,021	786,115	2,334,088	3,681,504
% to revenue ...	62	51	49	49
Cost per unit ...	3·82d.	2·47d.	1·60d.	1·07d
Cost of add. units, £	...	543,094	1,547,973	1,347,416
Cost per add. unit	...	2·13d.	1·36d.	·68d.
Gross profit, £ ...	149,056	770,147	2,429,028	3,846,817
% to capital ...	3·3	6·4	6·3	6·6
Inc. in gross profit, £	...	621,091	1,658,876	1,417,794
% to add. capital ...	...	8·3	6·3	7·2
Load factor, total output	...	11·0	14·7	18·7
Load factor, add. output	...	...	16·3	23·3

The amount of capital invested had increased from four to nearly sixty millions of money in fifteen years.

Ascertaining the cost of the extra units sold from year to year, and the extra capital charges incurred in supplying the extra units, gave some very valuable assistance when working out the price to be charged to cover the cost of supplying large consumers. Applying this method to the past seven years' records of the undertaking with which he was connected, during which time the output had increased nearly tenfold and large extensions had been carried out to plant and mains, he found that the extra generating costs amounted to ·203d. per unit, the extra capital charges on plant to ·154d. per unit, the extra distributing costs—*i.e.*, repair and capital charges on mains, &c., to ·234d. per unit, and the extra management charges to ·087d. per unit, so that the total additional cost of supplying the extra units amounted to ·768d. per unit. The load factor of the increased output had been 23·2 per cent. The capital cost per KW. of plant and mains installed had decreased from £139 in 1894 to £72 in 1909; the number of units sold per £1 of capital invested had increased from 3·4 to 14·2; the average price charged had been reduced from 6·16d. to 2·16d. per unit, and the gross profit had gone up from 3·3 per cent. to 6·6 per cent. Whereas the cost of the plant and mains added during the period 1894 to 1899 was £92 per KW., the cost of the additions during the period 1904 to 1909 was only £57 per KW., and the additional working expenses for the increase in the output between 1894 and 1899 was 2·13d. per unit, whereas the cost for the increase in output between 1904 and 1909 was only ·68d. per unit. There was a difference of 293,095 KW. between the total capacity of the plant installed and the maximum load recorded; that is to say, no less than 37 per cent. of the total plant was provided as spare. This represented a capital expenditure of over six millions, which was entirely unproductive, inasmuch as it did not earn one penny of income.

Within a distance of 8 or 10 miles of the Manchester Town Hall there were some 20 public generating stations, having between them a total capacity of 100,000 KW., which had probably cost over two million pounds. To construct a system of mains partly above and partly below ground, so as to interconnect these generating stations, would cost about £150,000, but by so doing it would be possible to reduce the quantity of spare plant from 37 per cent. to, say, 12 per cent., and enable the existing stations to supply an increase in load of 25,000 KW. without any further expenditure, thus making use of existing plant having a value of about £500,000 at a cost of £150,000 on mains. Some additional expenditure would be necessary to provide converters at some of the existing works, but against this might be put the saving in working expenses through running the plant at higher efficiencies.

Bearing in mind the rapidity with which power stations were constructed one after the other about 1894, it might be said that with the knowledge and experience then available the majority of the work was carried out on lines that had very well withstood the test of time. It appeared to him that only one serious mistake was made, which had only become apparent as one extension after another had had to be carried out—the common practice originally adopted of erecting the generating stations in thickly-populated districts, in order to keep down the expenditure on mains, without taking into consideration either the facilities provided for obtaining delivery of fuel, the provision of an adequate supply of water for condensing purposes or providing ample room for extensions.

The growth which would take place was very much underestimated, and in consequence of this want of foresight it had been necessary in many cases to construct new generating stations on more suitable sites, or to make good the deficiencies of the existing sites at considerable expense.

The reduction in the average cost per unit between 1894 and 1909 had been brought about principally through the increase in the output and the better load-factor conditions, but these influences did not appear to be sufficient to account for the reduction which had taken place in the fuel cost; speaking broadly, there had not been any considerable change in the design or arrangement of generating plants to account for this reduction.

At the present time equally good results were apparently being obtained from both the impulse and the reaction type of turbine, but it would appear that the impulse machine was being used to an increasing extent in the large sizes. The tendency of turbine construction was to increase the clearances, reduce the number of stages and to shorten the length between bearings, and progress along these lines was likely to be more successful with the impulse than with the reaction machine.

The question of some importance to supply undertakings was to what extent the costs could be reduced by the employment of exhaust steam turbines.

In order to illustrate the effect of installing exhaust turbines in an existing generating station, he assumed a case where 4,000 KW. of reciprocating plant was installed, and worked out the costs.

His conclusion was that for public generating stations, the circumstances would have to be exceptional to result in any ultimate advantage from installing exhaust or mixed-pressure turbines, as compared with high-pressure turbines of equal capacity. A very wide field, however, existed for the application of exhaust turbines for other purposes, such as collieries, rolling mills, ship yards, and other industries particularly where large non-condensing engines were used. In many such cases the output could be increased 100 per cent. with the same consumption of fuel, and electric motors supplied from the generator connected to the exhaust turbine could be substituted for the many small non-condensing engines usually required for other duties, so effecting a still further saving in the fuel consumption. Inasmuch as the load factor was slowly but surely improving, it was not unlikely that in the near future it would be found economical to install gas engines to deal with at least that portion of the load having the highest load factor.

For a direct-current station situated in a good position for obtaining coal supplies, a combination of gas engines as the prime

movers with large storage battery capacity, appeared to be an excellent arrangement. The combination would not much exceed in cost the steam plant capable of dealing with the same maximum demand, and as the working load factor of the gas engine would probably reach, if not exceed, 60 per cent., there was little doubt that the fuel costs and the working expenses generally would be lower than for the steam station.

Power station engineers were evidently appreciating the many advantages incidental to the use of storage batteries on a comprehensive scale. During the last few years batteries many sizes larger than previously contemplated had been put into use, and the ideal conditions of supply of gas and water undertakings in regard to storage might even be realised in the near future.

The best results were now obtained from large plants, although they sometimes had to be worked on light loads; small sets had to be replaced by large ones, and those responsible for the management should use every opportunity to provide funds, whether under the heading of reserve or depreciation to enable the value of such obsolescent plant to be entirely written off from to time, so that the net capital expenditure should only represent the value of the plant capable of being usefully and economically employed under modern conditions.

There was no doubt that many manufacturers appreciated, and had taken full advantage of, the improved results obtained by using direct-current motors with efficient long range speed regulating devices, and would not have a constant-speed motor, even if it were given to them. Two textile manufacturers in Bury had installed a few direct-current motors with shunt regulators to drive a portion of their premises; these worked very well, and he was subsequently approached in regard to the driving of the remainder of the mills. In each case, on pointing out how much better it would be to use constant-speed A.C. motors with no brush or commutator troubles, he was told that they did not want constant speed, as they had found it exceedingly convenient to alter the speed slightly to suit the work they might happen to be engaged on, and they had not experienced any commutator troubles.

The development of our public supply undertakings had been very materially assisted by the hiring-out of different kinds of apparatus, particularly of motors, and Mr. Watson pointed out that inasmuch as Parliament had granted powers both to municipalities and to companies to establish and to work electrical supply undertakings, the same treatment should be meted out to both alike. If an undertaking established by a company in one district was allowed to supply its consumers direct with hired apparatus, it would be very unfair to debar a similar undertaking established by a local authority in a neighbouring district from doing the same thing. The majority of municipal undertakings were directed and managed at least as well as those financed by private enterprise.

It was probably less difficult to ascertain the amount to be charged to individual consumers on account of the working expenses of the generating plant than to arrive at a fair figure for the cost of distribution. Apart from other factors, an appreciable difference in price should be quoted to a consumer who only necessitated an expenditure £100 on mains as compared with another at a distance on whose behalf £5,000 had to be spent.

The cost of meter reading and repairs, office expenses in making out and collecting accounts, depended entirely on the number of consumers supplied and was independent of the consumption of each consumer. Assuming that 500 consumers were supplied using between them 1,000,000 units a year and that the cost of the above items came to £500 a year, equal to £1 per consumer per annum, or an average cost of ·12d. per unit on the total consumption, if one additional large consumer were connected using another 1,000,000 units a year, which at a power rate of a halfpenny per unit would give an income of rather more than £2,000 a year, the extra cost of the items mentioned would only be £1 per annum instead of another £500, and it would be grossly unfair to reduce the charges to the other 500 consumers by ·06d. per unit and to charge the larger consumer ·56d. instead of ·5d. per unit when the actual cost of supplying him was quite an insignificant sum. Moreover, the difference between the price of ·56d. and ·50d. per unit on the output supplied to the large consumer was 12 per cent., and represented in cash nearly £250 a year, no small matter in these days of competition.

He mentioned these two aspects of the problem to illustrate the difference which must be made in the charges as between one consumer and another if the business was to be carried out on sound commercial lines, and how unjustified was the contention so often put forward by those insufficiently acquainted with the subject that all consumers should be charged alike, without taking into consideration all the circumstances of the case.

He had heard the remark made time after time, that if any great progress was to be made in the application of motor power supply from public mains, the price would have to be brought down to about ·30d. per unit, because that was the total inclusive price (usually stated as rather on the high side) it was costing large consumers to work their own plant. If there was one fact more than another which stood out prominently in connection with most of the supply undertakings in Lancashire, it was the tremendous growth in the demand for power supply during the last few years.

He felt quite sure that it was unnecessary to quote so low a figure nowadays. Many large manufacturing concerns had found it remunerative in the long run to purchase from outside sources at prices varying between ·75d. and ·50d. per unit, depending on the conditions, but unfortunately it was difficult to get those who had made the change to come forward and give facts and figures to show what electrical driving had done for them. There was not the slightest doubt also that a price between ·75d. and ·50d. per unit was quite sufficient to enable most of the larger undertakings to maintain and even improve their financial positions, as their accounts showed, that with the access of the power load at these low prices the working expenses per unit had been very largely reduced and improved financial results attained. These prices were only intended to refer to mills or workshops using the supply during ordinary factory hours, and where fuel could be obtained at about 8s. per ton. For longer hours the price could be appreciably reduced.

During the past 15 years the price of all standard electrical apparatus had been reduced 50 per cent. to 75 per cent.

The only matter for regret was that many of the old-established manufacturing concerns who had contributed so largely to the success of the industry, had not themselves received the financial reward their services deserved. He could hardly believe that the small increase in price necessary to re-establish the majority of manufacturers in a strong financial position would have any appreciable effect on the demand, and unless greater financial stability could be secured in one way or another, it would be difficult, if not impossible, to maintain our position in the vanguard of the army of progress.

It seemed more than probable that, when a future address or paper was written dealing with a similar period to that covered by this address, less changes and improvements would have taken place than had occurred during the past period.

A New Steam-Electric Locomotive.

At the opening meeting of the Glasgow University Engineering Society, held in Glasgow on Friday, October 29th, Mr. Hugh Reid, deputy-chairman and chief managing director of the North British Locomotive Co., delivered his inaugural address as honorary president. The subject was "The First Steam Turbine Electric Locomotive," and Mr. Reid described a new type of engine at present under construction on the Reid-Ramsay system at his firm's works. Mr. Reid explained that various proposals had been made to electrify existing steam railways, but the anticipated cost for conversion and of prospective and subsequent maintenance had hitherto prevented progress. Attempts had been made to introduce independent self-generating electric units that might operate over existing railway systems without necessitating any electrical equipment on the railways themselves. The Heilmann steam-electric locomotive, built in 1894, was the most notable of these attempts, and the Reid-Ramsay locomotive was a development of that idea, but on a different and more practical basis. Proceeding, Mr. Reid gave the following description of the new engine:—Steam is generated in a boiler of the ordinary locomotive type, which is fitted with a superheater, and the coal and water supplies are carried in the side bunkers and side water tanks at both sides of the boiler. The steam from the boiler is led to a turbine of the impulse type, running at a speed of 3,000 R.P.M., to which is directly coupled a continuous-current, variable-voltage dynamo or generator. The dynamo supplies electrical energy at from 200 to 600 volts to four series-wound traction motors, the armatures of which are built on the four main or driving axles of the locomotive. The exhaust steam from the turbine passes into an ejector condenser, and is, together with the circulating condensing water, delivered eventually to the hot well. As the water of condensation is free from oil, it is returned from the hot well direct to the boiler by means of a feed pump, and the supply of water carried in the tanks is actually circulating water for condensation purposes. It is circulated by by means of small centrifugal pumps driven by auxiliary steam turbines placed alongside the main turbine and dynamo. The cooler is situated in front of the locomotive, where the full benefit of the blast of air caused by the movement of the locomotive, aided by a fan, is utilised. As the condensation of the exhaust steam deprives the locomotive boiler of the usual exhaust blast, in the experimental locomotive, forced draught is provided by means of a small turbine-driven fan, placed within the cooler, so that it will deliver hot air to the boiler fire, and at the same time assist the current of air through the cooler. The small switchboard and the instruments required, the controller for grouping the four motors in series, series-parallel and parallel, according to the drawbar pull to be exerted, and the regulator for controlling the voltage in the electrical circuit, and consequently the speed of the train, are all placed on the driver's platform within easy reach. The whole is mounted upon a strong under-frame, which is carried upon two eight-wheeled compound bogies so constructed that they will easily negotiate curves. Each bogie carries two of the four motors. The arrangement is the outcome of much thought and some experiment over a period of several years, and is being carried out on a large scale, and at heavy cost. As the engine is intended for express passenger main-line work, it is hoped to obtain comparisons from its actual working with the performances of the reciprocating steam locomotives, especially as regards the relative consumption of fuel and water, and as to the efficiency of transforming the energy of steam into draw bar or train pull, and also the relative rapidity of acceleration under the old and new systems.

Most of the component parts of this steam turbine electric locomotive have already proved themselves effective and efficient in other applications, and the novelty lies in the combination of the different elements of which the locomotive is composed. The expected results in this case should not therefore be so problematical as in an invention where the novelty is in the details, and it is the question of the cost of the locomotive which most troubles the patentees or raises any doubt as to its free adoption. A steam locomotive can now be produced at a very moderate first cost in

up-to-date establishments with modern machinery and scientific organisation in comparison with any arrangement involving the use of expensive electrical apparatus.

FOREIGN AND COLONIAL TARIFFS ON ELECTRICAL GOODS.

GUATEMALA.—It is necessary that the exact net and gross weight in kg. should be marked on each package, and specified on invoices, bills of lading, and certificates of origin. The net weight of each class of goods included in a package should be stated, and the origin of the goods must be declared on all documents. Invoices must be made out in quadruplicate on special forms, and must be signed by the Consul for Guatemala. Invoices and sworn declarations must be signed by an authorised member of the exporter's firm, and in no case by irresponsible clerks, brokers, or shipping agents. Strict compliance with the regulations is required.

The following fees are payable:—

When the amount of the invoice is under £20 ...	£0	14	0
" " " from £20 to £100	1	0	0
" " " from £100 to £200	1	8	0
" " " from £200 to £600	1	12	0
" " " from £600 to £1,200	2	0	0
and for each additional £200, or part thereof	0	4	0

Forms of invoices may be obtained from the Consuls for the Republic of Guatemala.

50 per cent. of the amount of duty leviable must be paid in American gold (*i.e.*, peso = 4s. 2d.); the remainder may be paid at the currency rate of exchange.

Kg. = 2·204 lb.

The following goods are admitted free of duty:—Asbestos in fibre or plates in natural state; articles imported for the State or the Municipalities, for the public service or the service of charitable institutions; lights for lighthouses, or harbour lights; galvanic batteries; electrical machinery and batteries not charged, destined to a public service.

The following duties are payable:—

	Pesos per kg.
Axles and axle boxes, iron or steel, of all kinds... ...	·10
Iron lamps, complete or in parts	·30
" gilt, silvered or nickeled	·50
Machines for various industrial purposes	·10
" worked by water or steam power	·02
Machines or motors, steam or wind	·02
Iron pulleys for transmission belts...	·02
Iron wheels for cars, &c.	·10
Tubes or pipes of iron	·02
" coated with brass, copper, &c.	·05
Chandeliers of copper	·60
" " gilt, silvered or nickeled... ...	1
Articles not specified in the Tariff, of copper	2
Bells of copper	·60
Candelabra of copper, gilt or silvered, with or without foot of other material, weighing up to 10 kg. each ...	1·50
Ditto, weighing more than 10 kg. each	·75
Lead tubing	·05
Lamps of copper	·60
Ditto, gilt, silvered or nickeled	1
Transmission belting of leather when not forming any part of any particular machine...	·30
Manufactures of glass or crystal not specified in the Tariff	1
" porcelain, faience or earthernware not specified in the Tariff	·75
Ditto, ornamented with silk, metal, &c.	3
Candelabra of crystal or glass	·50
Lamps of crystal or glass with or without accessories of metal	·60
Ditto, of faience or porcelain...	·60
Articles of aluminium not specified in the Tariff	4
" gutta-percha or celluloid	1
Wire of iron, galvanised, or of copper insulated for the transmission of electricity	·01½
Electrical apparatus	·02
Pumps of iron or bronze	·02
Globes, glass, for incandescent electric lights	·02
Locomotives, carriages, tools and materials for railways...	·02
Lightning rods	·02
Lamp-shades of all kinds not specified, with or without their metal frames	4

GUERNSEY.—All goods imported into the island of Guernsey pay a tax of 1s. 8d. per ton of 2,000 lb. gross, with a few unimportant exceptions.

NEW PATENTS APPLIED FOR, 1909.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by Messrs. W. P. Thompson & Co., Electrical Patent Agents, 322, High Holborn, London, W.C., and at Liverpool and Bradford, to whom all inquiries should be addressed.

23,803. "Improvements in audible electric signalling devices and the like." T. S. Rogers. October 18th.

23,808. "Improvements in portable electric lamps." G. N. Vitanoff. October 18th. (Complete.)

23,814. "Improvements in and relating to the manufacture of electric incandescent metal-filament lamps." H. Hirst and The Wolfram (Tungsten) Metal Filament Lamps, Ltd. (Date applied for under Rule 13, January 4th, 1909. An invention comprised in application No. 142, dated January 4th, 1909.) October 19th. (Complete.)

23,819. "Improvements in apparatus for cooking and like operations by means of electricity." G. G. Bell and J. St. V. Pletts. October 18th.

23,821. "Improvements in clamping and supporting devices for electrical condensers." Siemens Bros. & Co., Ltd., and C. R. Riber. October 18th. (Complete.)

23,834. "Improvements in or relating to telephonic apparatus." E. A. Graham. October 18th. (Complete.)

23,863. "Improved method of and means for charging electrical accumulators or secondary batteries." J. Schmeltz. October 18th. (Complete.)

23,937. "Distributing box for cables with multiple electrical conductors." R. Monnier. (Application for Patent of Addition to No. 13,129, 1909. Date applied for under Sec. 91 of the Act, October 19th, 1908, being date of application in France.) October 18th. (Complete.)

23,938. "Improvements in electrical transformers." C. Le G. Fortescue. (Date applied for under Sec. 91 of the Act, November 19th, 1908, being date of application in United States.) October 19th. (Complete.)

23,980. "Improved means for supporting electric lamps." H. S. Harrison. October 19th.

24,016. "Improvements in current collectors for electrically driven vehicles." British Thomson-Houston Co., Ltd. (General Electric Co., United States.) October 19th.

24,017. "Improvements in and relating to signal systems." British Thomson-Houston Co., Ltd. (General Electric Co., United States.) October 19th.

24,028. "Improvements in and relating to dynamo-electric machines." E. K. Scott. October 19th.

24,028. "New and improved adhesive Morse slip and automatic damper for use with telegraph recording apparatus and the like." C. T. Pounsford and F. T. Love. October 20th.

24,076. "Improvements in or relating to electric burglar alarms and the like apparatus." A. Bloch. October 20th.

24,079. "Improvements in suspension chains for electroliers, electric lamps and like electric lighting apparatus." R. Peyton. October 20th.

24,109. "Improvements in electric switches." H. J. Carrigan. October 20th. (Complete.)

24,126. "Improvements in and relating to dynamo-electric machines." British Thomson-Houston Co., Ltd. (General Electric Co., United States.) October 20th.

24,127. "Improvements in and relating to the regulation of the voltage of alternating-current machines." Hon. C. A. Parsons and A. H. Law. October 20th.

24,130. "Electric pocket igniter," F. Deimel. October 20th. (Complete.)

24,134. "Improvements in apparatus for the production of continuously-maintained and sustained oscillations of electricity." H. Manders. October 20th.

24,137. "Improvements in dynamo-electric machinery." Bruce Peebles and Co., Ltd., and P. D. de la Cour. October 21st.

24,185. "Improvements in electric signalling installations." Siemens and Halske, Akt. Ges. (Date applied for under Sec. 91 of the Act, October 21st, 1908, being date of application in Norway.) October 21st. (Complete.)

24,187. "Aerial resonator for receiving apparatus of electrical wireless systems." C. Bardeloni. October 21st. (Complete.)

24,190. "Improvements in electric signs." L. Miller. October 21st. (Complete.)

24,208. "Improvements relating to apparatus for controlling electric motors." H. E. Dey. October 21st. (Complete.)

24,269. "Improvements in or relating to the driving and operation of electric frequency transformers having commutators." Siemens Bros. Dynamo Works, Ltd. (Siemens Schuckertwerke G.m.b.H., Germany.) October 22nd. (Complete.)

24,275. "Improvements in or relating to means for receiving and recording telephonic messages or communications." N. P. Jasper. October 22nd.

24,276. "Improvements in dynamo brush holders." O. Höhne. October 22nd. (Complete.)

24,294. "Improved device for supporting the filaments of incandescent electric lamps." A. C. Hyde. October 22nd.

24,306. "Improvements in and relating to continuous-current motor-generators or transformers." Allgemeine Elektricitats Ges. (Date applied for under Sec. 91 of the Act, October 22nd, 1908, being date of application in Germany.) October 22nd. (Complete.)

24,236. "Improvements in and relating to fittings for electric candle lamps." J. S. Highfield. October 22nd.

24,372. "Improvements in or in connection with electric motors and other electrical apparatus." W. Alderson and J. H. Holmes. October 23rd.

24,373. "Improvements in electrical switches." N. Collins. October 23rd.

24,388. "Improvements in apparatus for receiving messages by wireless telegraphy or telephony." British Radio Telegraph & Telephone Co., Ltd., and J. G. Balsillie. October 23rd.

24,389. "Improvements in thermo-electric devices for indicating the temperature of steam on a steam locomotive." Siemens Bros. & Co., Ltd. (Siemens & Halske Akt.-Ges., Germany.) October 23rd. (Complete.)

PUBLISHED SPECIFICATIONS.

Copies of any of the Specifications in the following list may be obtained of Messrs. W. P. Thompson & Co., 322, High Holborn, W.C., and at Liverpool and Bradford; price, post free, 9d. (in stamps).

1908.

Electric Wireless Signalling. R. A. Fessenden. 13,865. June 30th. (Date applied for under International Convention, July 1st, 1907.)

Electric Switches and Switch Arrangements. H. J. Fisher, F. Coates, H. W. Clothier and A. Reyrolle & Co. 20,590. September 30th.

Process for Fastening the Filaments of Electric Incandescent Lamps to their Electrodes. T. McKenna. (Glühlampenwerk Anker-Ges. 20,915. October 3rd.